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LIGHT ✂ HEAT ✂ POWER ✂ BYE-PRODUCTS

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PROPRIETORS: WALTER KING, LIMITED. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

Telephone: Central 6055. —— Telegrams: "GASKING, FLEET, LONDON."

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EDITORIAL NOTES.

New Moves.

THE coal stoppage and the dispute which protracts it entered upon a new phase last week. It was announced in the House of Commons by the Prime Minister that the Government had decided to introduce simultaneously two Bills. One deals with the reorganization of the coal industry; the other, containing a single operative clause, will, without abrogating the existing legal seven-hour day in the mines, add to it, for a definitely prescribed period, another hour—making the working period per day eight hours. It is expected that the latter measure will only take about a fortnight to get through Parliament; but the reorganization proposals will absorb a longer period. The hope of the Government, however, is that the Bill will become an Act before Parliament adjourns in August. As might have been expected, the Labour-Socialist Party in the House strongly resent the prolongation, even temporarily, of the working-day in the mines; and they have resolved to obstruct the Bill as far as possible at every stage. Looking at the matter from the point of view of outside observers, we think the Government are making a mistake in applying the extension of hours to a defined period. In the first place, it is largely due to the seven-hour working shift, the overmanning of the pits, and the reduced output per man-shift, that the cost of production has risen to such an extent that the economic position of the industry has been shattered, and is now in a state where it cannot compete on equal terms with other coal-producing countries. It seems to us that, in proposing only a limited period for the extension, the Government have taken the line of least resistance. The fact that they have made the proposal at all shows that they see where the weakness exists in the economic condition of the industry. This being so, it would, we feel, have been much better had they "taken the bull by the horns," and insisted upon a reversion to eight hours. The seven-hour day has been a great experiment, and an expensive one to the country. It has failed; and the lessons should be applied now while the Government are dealing with what is obviously necessary for recuperation. At the end of the period during which the eight hours are to apply, we fear that the whole matter will be again raised, because it is clear that, unless production per man-shift is permanently increased, the industry will, in view of the conditions of the coal industries in other countries, once more suffer the effects experienced since the installation of the seven-hour day. The Government have been accused during the discussion of their proposal of having taken sides with the owners, instead of being impartial arbiters. The Government have not altered their position one whit. What they have done has been to take the side of commonsense, and to apply intelligence to the conditions as they have existed, and as they stood at the time this deplorable stoppage took place. It has put the country in a position which has done its industries and commerce an infinite amount of harm—harm which extends to the workers themselves, who, we believe, for long to come, will see in their midst a great enlargement of unemployment.

One happy feature last week was the increased return to work of miners in certain areas. Towards the close of the week, it was reported that the miners had wholly or in part resumed work in over twenty collieries, chiefly in Warwickshire, Nottinghamshire, Derbyshire, Staffordshire, and Kent; and in all districts there appears to be a greater willingness on the part of the men to face an extension of hours so long as the *status quo* in respect of wages is maintained. At the annual meeting of the Mining Association on Thursday, the President (Mr. Evan Williams) strongly urged upon the members the desirability of offering the best terms possible in every district, in conjunction with the eight-hour day; and this is probably the correct attitude, in view of the evident willingness of the men in so many cases to abandon idleness and the dictation of the Federation rulers, and resume work, although giving to it a little more time per day. In some cases where the pits have been worked at a loss, notices have been posted to the effect that, if the men will not return to work on the best terms which can be afforded, the collieries will have to be closed; and this will mean that those who formerly were employed in them will have to seek work in other directions. From Cumberland comes the information that the Allerdale Coal Company, Ltd., have placed before their workers a co-operative scheme for running the collieries. It is to be on a co-partnership basis, which will extend to management, and under which the whole of the profits for the first twelve months will be devoted to the payment of wages—no part of it during the year going to dividends or directors' fees. While all this is going on, the views of the Miners' Federation remain unchanged. They are still opposed to district settlements, to an extension of hours, and to any reduction of wages. Nevertheless, there seems to be little question now that the miners themselves will largely settle the matter for the Federation, and over-ride the obstinacy which has risen to the very acme of foolishness. It is humorous, even in the tragic circumstances, to find Mr. Cook still saying that the men are not going back, and that little exotic coal is coming into the country. Either the facts are unknown to Mr. Cook, or his statements can be characterized by a word of extreme brevity.

With regard to the importation of foreign coal (for producing which the miners in other countries are earning money while our miners are idle), it has reached this country in hundreds of thousands of tons, and the daily deliveries are growing in importance. As a matter of fact, in the very first month of the stoppage (up to May 30), no less than 219,000 tons from other countries were received in Great Britain. Gas undertakings who see the probability of pressure through the running down of stocks have been advised to consider seriously the question of the purchase of foreign coal; and perhaps for their purpose they will prefer the American material. An important point to note is that it takes some little time for the coal to be brought such a distance; so that arrangements should be made early for it if there is a prospect of stock depletion. The coal has to be brought over in cargoes of 5000 tons or more, so that there will have to be a good deal of co-operative working by those who consider that prudence would justify them in entering into a contract for participation in a delivery. It is understood that American coal was being delivered in the Thames a week or two since at a cost of 35s. per ton. We have no doubt that the more intelligent among the miners realize the fact that the longer the stoppage lasts, the more time will be given to the coal industries of other countries to get well established in our markets abroad (they are making long-period contracts while the Miners' Federation are giving

them the opportunity), which will mean that less British coal and fewer British miners will be required after the stoppage than before it.

After the above had been set in type, it was learned that, complying with the desire of the Labour-Socialist Party in the House, the Government had consented to the Bill for reorganization being taken first; and it is expected that this measure will be debated to-day. The second reading debate on the Hours Bill will not be taken before Monday or Tuesday. It is pointed out that the latter will be permissive in character, and so allow, according to the necessities of each colliery, the owners and men agreeing to an extension of time up to eight hours—that is, the time may be seven-and-a-half or eight hours, as conditions demand. The Seven Hours Act will be suspended for five years. One thing that has emerged from this discussion is that, in view of the great differences that exist between colliery and colliery and district and district, a national agreement as to wages and hours is totally incongruous.

Determination of Traces of Carbon Monoxide.

MANY readers of the "JOURNAL" will have studied with interest the communication on the "Determination of Traces of Carbon Monoxide"—which appeared in our issue for the 9th inst., p. 530—from the Research Laboratories of Messrs. Radiation Limited. At the formal opening of the new Central Laboratories last October, the Chairman of the Company (Mr. H. James Yates) stated that a large proportion of the time of the staff would be devoted to research on subjects of general and fundamental interest to the appliance section of the gas industry. The communication in question is, we hope, the first of a series; and we venture to think, having studied this example of the work in hand and in prospect, that the claim of Radiation Limited—to serve the whole gas industry by means of their Research Laboratories—will be granted on all sides.

The advance in gas-heating appliances—which has been so marked in recent years—has, to a large extent, been due to improvement in the burners, ensuring complete combustion. In many of the older types of appliance the combustion was not perfect, and a low thermal efficiency resulted. In the modern type of gas-heating appliance, the efficiency has largely been increased as a result of perfect combustion, and the scientific utilization of the flame and its products of combustion. In addition, however, the attainment of perfect combustion is of importance from another aspect—the hygienic.

Considerable attention has been recently focussed on the possible dangers of carbon monoxide; and the perfecting of any methods of test enabling this gas to be accurately determined, even when present in only minute traces, is of the utmost importance. In the investigation under consideration, the well-known reaction between carbon monoxide and heated iodine pentoxide has been utilized, and the method has been explored so that a very high degree of accuracy is attainable. Briefly, the sample of the products of combustion, after suitable purification and dehydration to remove gases and vapours which would interfere with the reaction, is passed over a continuous column of heated iodine pentoxide. The carbon monoxide is oxidized to the dioxide, and an equivalent quantity of iodine is liberated. This is absorbed in dilute potassium iodide solution, and is subsequently estimated by titration, using a dilute standard solution of sodium thiosulphate, or of alkaline potassium arsenite, with starch emulsion as an indicator. Owing to the extremely minute quantities involved in the various reactions, great care must be expended on the details of the apparatus and procedure. The glass used in the various vessels must not itself show a tendency to decompose the reagents. A certain type of absorption vessel for containing the potassium iodide solution is recommended; and the stability of the dilute solutions and the actual detailed method of titration are dealt with in the communication.

It is pointed out that grave inaccuracies may occur—in fact, the information may be totally misleading—unless the iodine pentoxide is in a definite condition before a determination is made. The reagent must be tested for activity, using a mixture of carbon monoxide and air of known composition. This is necessary owing to the hygroscopic character of the compound. A source of trouble to previous users of this method has been the difficulty of obtaining an absolute, or a very low, "blank" when air, previously freed from carbon monoxide, is passed over the actual sample of iodine pentoxide used in the determination. The communication from Radiation Limited describes how this "blank" can be reduced to a negligible figure; and it further deals with the reason for the appearance of the small positive "blank." An accuracy of work amounting to a few parts per million is, we gather, claimed for the method. This is a very high degree of accuracy; but it is necessary in this particular determination, in order that minute traces of carbon monoxide can be detected and precautions taken to obviate their appearance in gas-heating appliances. Radiation Limited, we learn, apply the test for freedom from carbon monoxide to all their gas-heating appliances. We feel sure that the general application of this method of test will greatly tend to rebut the complaints which have sometimes been levelled against gas-heating appliances on the ground of imperfect combustion.

Sulphate of Ammonia Crystals.

CONSIDERABLE attention has been directed of late to the importance of crystal size in sulphate of ammonia. There is good cause for this. Certain of our overseas customers have complained bitterly of the condition in which some of the bye-product sulphate reaches them. The powdery form results in caking; and thus the salt has to undergo crushing before it can be used. Such complaints cannot be neglected, particularly when the synthetic product is delivered in good pea crystal form. Moreover, complaint has been followed by action, resulting in the loss of substantial business, which in these days bye-product sulphate can ill-afford to suffer. Therefore, crystal size is a matter of pressing moment; and the technical considerations must be carefully explored, and the remedy applied. In an article in later columns, Mr. H. J. Hailstone, A.M.I.Chem.E., discusses the subject from the technical point of view in the thorough manner which its importance claims. Among his preliminary suggestions is that possibly one of the greatest hindrances to progress in this matter has been the lack of a generally adopted definition of required crystal size; and, until this is provided, producers will be left very much in the dark. The drafting of a suitable specification is one of the first needs. Whether or not the standard could be generally met, it would serve as a goal to which to work. While the methods of operation are known by which large crystals can be realized where this is not already the case, there are several attendant conditions and aids to control which are essential, and which call for investigation. They have recognition in the article, and other workers have been examining them. They will all come in time; but we cannot wait for them, seeing that it is imperative that bye-product sulphate should promptly establish an equality with the synthetic production in this matter of the size of crystal which will be more acceptable than the caked powder of which our overseas buyers complain. We do not blame anybody for not buying what they do not want; we do blame producers for not pursuing practices which will give buyers what they demand, especially when it is procurable from another source.

Mr. Hailstone treats of many matters which affect this problem of crystal growth, and quotes authorities. The subject of saturator control is dealt with, and also crystallization, in which latter connection it is shown that a definite rate of growth of the crystals is obtained under certain conditions of temperature and super-saturation. The effect of agitation and circulation of the crystals, the advantage of securing the maximum area of crystal surface, and other matters are discussed. At the end of this section of the article, our contributor says: "The "problem seems to resolve itself into two aspects—first, "to maintain the correct physical conditions for a suffi- "cient time for crystals to grow, a question of saturator "design. And, secondly, to secure unvarying low acidity, "a case for adequate control." Saturator design comes under review; and it is clear from what Mr. Hailstone says that we have here a case for co-operation between

plant manufacturers and users in designing a vessel which complies with the requirements enumerated in the article. In this regard, certain suggestions are made by him, as also in connection with saturator control and the maintenance of correct conditions of acidity. In this relation, our contributor deals with the important question of saturator testing; and he appears rather inclined to favour an instrument used by G. Boizard for determining the electrical conductivity of mixtures of sulphate of ammonia and sulphuric acid and water. There are difficulties to be overcome in connection with this method; but if these can be successfully negotiated, then it is the view that a thoroughly reliable and trustworthy method may be elaborated. Mr. Hailstone says that the instrument serves to show at a glance the degree of acidity—thus enabling the operator to regulate the acid supply, and to maintain the constant conditions which ensure the production of large crystals. A correction factor may be used to compensate for special conditions of temperature or output. From this he foresees the further step of providing automatic regulation of the acid feed by the same means.

In this reference to the article, we have only glanced at a few of the points raised. They have all direct applicability to a matter which is of great technical importance to the industry, in view of the imperative claims made at the commercial end of the sulphate of ammonia business.

Explosion in a Tankless Gasholder.

THROUGH, we believe, references in American papers, information has got abroad regarding an explosion of a waterless gasholder at Posen, Poland. Inquiries have been made of us as to whether we have any authoritative information concerning the matter. We have; and it was kindly supplied by the Engineer of the Posen works. The experience is a serious one; but, in fairness to a comparatively new form of construction, we should like to emphasize two points: (1) That the holder in which the accident occurred was erected in 1916, when this type of construction was first introduced, and the builders were without any considerable working experience, as they have now. Admittedly, in the past decade, the details of the holders have been greatly improved; and there are now a number of varying size working satisfactorily. (2) That the severities of the climate at Posen are such that even the water in the sealing tar readily freezes on the holder walls.

Bearing the foregoing points in mind, the authentic particulars of what actually took place are very simple. To put them briefly, they are: The holder in question is of the disc type of 50,000 cub.m. capacity (about $1\frac{3}{4}$ million c.ft.). Between the disc and the holder wall was a canvas trough with tar seal, in order to prevent the escape of gas above the disc. The Engineer reports that the seal required considerable attention and watching. Yet large leakages of gas occurred. In 1917, several months after the holder was put into operation, 34,000 cub.m. of gas were lost, and the side walls were ripped open. In the winter of 1919, 17,000 cub.m. of gas escaped. The Engineer also states that, under the conditions of his working, the safety of the holder decreased with the outside temperature. At $-10°$ C. the tar became so stiff that it could be pumped to the top only with great difficulty. The water content of the tar froze readily on the holder wall; and it was owing to the ice clinging to it that the joints worked badly—thus resulting in small as well as large gas escapes. In these circumstances, one can well understand that the canvas used for the joint would be working under detrimental conditions; and in such cases it would be somewhat difficult to ascertain precisely when the time had arrived to change the canvas, which is a somewhat expensive operation, and is likely to require the holder being put out of service for some time.

With reference to the explosion, on its eve a smell of gas was noticed; and it was found that the tar was running out of the seal in large quantities, necessitating the continuous use of five pumps to maintain the supply of tar. It was concluded that the canvas had become defective; and it was decided to put the holder out of action. For this purpose gas was only discharged from the holder; the inlet having been closed. Shortly before the explosion occurred, one of the attendants noticed unusual noises within the holder, and he hastened to inform the foreman. But the explosion took place almost immediately after. The Engineer states that his view is that what happened was that the disc jammed when moving downwards. It became tilted, and allowed so much gas to escape into the holder above the disc that an explosive mixture formed between the disc and the roof. The pressure under the disc being reduced, the disc started to slip down, and the friction produced a spark which ignited the explosive mixture above it.

This experience is a serious one, and cannot be overlooked, notwithstanding the growth on the Continent and in America of the adoption of this type of holder. The explosion shows the possibility of leakage past the disc to the top of the holder, and the creation there of an explosive mixture, and of an igniting spark. It is not our business to suppress information of this kind. In the interests of the industry, it should be generally known, because there must be complete assurance of immunity from happenings of the kind, in such a vital and expensive part of the equipment of a gas-works.

Education of Employees.

DOES the education of employees pay? That was the question with which Mr. F. W. Goodenough, C.B.E., opened a paper which he prepared for the annual conference of the Association for Education in Industry and Commerce [*ante*, p. 597], which body are doing excellent work in inculcating the principle among employers that trained intelligence in the worker is as necessary (though of a different order) as in the official or administrative ranks of their organizations. Does the education of employees pay? It is easy enough to answer the question in the affirmative by advancing a number of platitudes; but Mr. Goodenough, with twenty years' experience of employee educational and training schemes in the great Company with which he is connected, can answer the inquiry by practical results, and by the knowledge of the changes he has witnessed in the standards of competence of the men in his department, the work of which extends over an immense area in square miles. He has witnessed not only an improved standard of competence, but an elevation of the standard of personal responsibility among the men, which becomes more and more important the greater the area over which work of such varied nature is scattered, and the greater the reliance which business stability and progress must have upon that work. Let us suppose that the question quoted, instead of appearing at the top of Mr. Goodenough's paper, had been put to him, he would have smiled, and replied by putting the inquiry to his interrogator, "Why do you think the Gas Light and Coke Company continue developing the knowledge of their employees if they are not satisfied it is a profitable thing to do?" Their experience is that of many other undertakings in the gas industry; and from that individual experience comes the strong collective support that is given to the Institution educational schemes for young engineers, and for those whose work lies in the distribution and public service departments of gas undertakings.

The education that elevates a man's capacity and competence in his work is not only of value to him personally in several ways, but it is of inestimable worth, relatively to a man of less capacity and competence, to the undertaking he serves. Let gas supply be of consistent standard and pressure, and gas appliances most efficient when properly used, the incompetent workman may ruin the result; while the competent worker can complete the chain of efficiency to the advantage of the consumer, the reputation of the concern, and the progress of demand. Does the education of employees pay? When the effects are considered which proceed from incompetence, and those which issue and flourish from competence, it requires no spacious argument to carry conviction. There are, for instance, a thousand-and-one details met with in the public service work of a gas undertaking which cannot be reduced to rule-of-thumb treatment; and the exercise of the trained intelligence of the craftsman in dealing with them will make all the difference. Discrimination in the treatment of details can only come from the reasoning which education and training enable a man to apply

—no matter the nature of the work upon which he is engaged.

We have heard responsible gas men say, "Education of employees is all very well, but when you have educated them they often leave you, and enter the service of another gas undertaking." Why is that? It is not the education that causes them to migrate; it is something else, and that "something" needs investigation. A man does not, as a rule, change from one employer to another if he is comfortable, and knows that his work and conduct are approved. If all gas undertakings took in hand individually or by co-operation the work of educating employees not only practically, but in the fundamental principles applying to work, any migration that might take place would not matter; the general qualification standard of gas employees being raised, equally competent men would be available to fill the vacancies. The undertakings we do not like are those which, negligent themselves of this matter of efficient education and training, are not loth to offer temptation to men to transfer their services. But one generally finds that undertakings which provide for the education and thorough training of their employees are controlled by men in whose service the employees desire to remain. Another point is that schemes of education require to be well devised, and the instructors must be men of good accomplishments for their work. A bad scheme and an efficient instructor is almost as useless as a good scheme and an inefficient instructor. In either case, the maximum result cannot be achieved. The maximum result can only be secured by the scheme being all it should be, and the instructor a man possessing competence for the work. The work is worth doing well. Its aim is higher efficiency; the aim can only be realized by efficiency in the scheme and its conduct.

These and other thoughts are aroused by Mr. Goodenough's paper, which describes the educational work in the gas industry, relates experiences regarding effects, and spreads before its readers inducements which it is hoped will have excellent influence not only in the gas industry, but in other industries and trades of the country. We do not boast in the gas industry of what is being done. We are conscious of many weak places in this respect in the industry; we are conscious, too, that other industries can show examples of splendid operation in the same line. We want to learn of them, while at the same time glad to think and know that our own industry can offer example, practice, and experience which is not without interest and value.

Minimum Sliding-Scale Dividend.

In our "Parliamentary Intelligence" to-day will be found a report of the proceedings before the House of Commons Committee to whom was referred the Bill of the Gas Light and Coke Company, which, among other objects, proposes to modify the sliding-scale by the institution of a minimum dividend of 5 p.ct. On Monday the preamble of the Bill was declared proved.

Unclean Coal.

The London County Council (General Powers) Bill was considered last week by a Committee of the House of Lords. One of the clauses, it may be remembered, was for the purpose of making it unlawful in the County of London to sell coal containing an undue proportion of slate or slack or incombustible matter, and to impose penalties for contravention. In the result, the Committee amended the clause so as to make it unlawful for any person to sell coal in the county having admixed therewith an amount of slack or rock or incombustible matter which, having regard to all the circumstances of the case, constitutes an undue proportion of the total coal sold.

"Field's Analysis."

On a later page will be found an article dealing with the 1925 edition of "Field's Analysis." Comment is made upon several interesting features of the work. In our view, the new edition upholds in every way the tradition attached to the work; and congratulations are once again offered to Mr. H. E. Ibbs for its successful production. The work has now reached the fifty-seventh issue.

District Executive Boards.

To the National Gas Council the District Executive Boards are pillars of strength. Without them and their effective regional work, the central authority would not be the power that it is in the political work of the industry or in other matters which affect its interests. Reading through the annual reports of the District Executive Boards, one is struck by the amount of useful local work they have done—particularly in connection with the Government electricity scheme and the competition of bitumen with tar. Now the initial investigation is going forward which has for its objective the strengthening of the weak places in the industry, by absorption of small concerns, or by their supply in bulk from, and other arrangements with, the larger ones. This is a matter which is being enthusiastically taken in hand by some of the better circumstanced undertakings; and we are confident that the more the matter is looked into, the more this form of policy of providing for future development will be adopted. There is no question that, with its Central and Regional Boards, the National Gas Council form a complete organization in respect both of representation and effective activity.

Smoke Abatement Development.

Smoke abatement has reached the state of being a topical subject. It now crops up and is discussed in many places: and probably the most energetic people in the matter to-day are the Smoke Abatement League of Great Britain. They seem to get where good work is to be done in preaching the gospel of air purification by the rational expedient of stopping its pollution. But we must never forget those tenacious pioneers who worked for long years with little encouragement; they worked ardently and well, knowing they were right. The House of Lords are dealing with the Smoke Abatement Bill; and on June 8, the Health and Housing Committee of the Unionist Party in the House of Commons were addressed by Mr. A. Harland, M.P., a former Chairman of the Health Committee of the Sheffield City Council, on the subject of what that city has done in contributing to smoke abatement. Lord Newton, who has become our foremost political protagonist in this matter, also addressed those present. From the proceedings of the Birmingham Public Health Committee, we see that this body has determined to co-operate with other large cities in making a grant for three years to an Advisory Committee which has been set-up to investigate atmospheric pollution problems—the importance of the matter as affecting the health of the people being now more generally recognized by those responsible for the salutary conditions of our cities and towns. Again, at the annual "week-end" conference of the Huddersfield Corporation and officials, Dr. J. J. Jervis, Medical Officer of Health for Leeds, and Mr. C. Elliott, the Hon. Secretary of the Smoke Abatement League, gave addresses on the subject. Among the sapient observations of Dr. Jervis was: "If purity of food and water is demanded, why should not there be the demand for the same purity of air?" In his opinion the only way to solve the problem is by securing uniformity of action; and it is by the demand of the people that the problem is to be solved.

Road Fund.

Despite all the deputations and petitions from motor associations and road authorities, the Chancellor of the Exchequer has kept unswervingly to his view that roads and motorists are doing very well out of the Road Fund, and that the time has come for the Exchequer to participate in the proceeds of motor taxation. Clause 40 of the Finance Bill, which alters the sum to be paid into the Road Fund from the motor tax, was under discussion in the House last Wednesday; and there was little opposition save from the Labour-Socialists, with whose arguments Mr. Churchill was able to deal in light vein, probably knowing that financial expediency appealed more than anything else to those sitting at the back of the ministerial bench, and that therefore he was certain of getting his own way. He pointed to the fact that a greater amount is now being spent on roads than ever before, and that the rural and unclassified ones are receiving more attention. He also mentioned the big growth of motor transport, and referred to the expectation that this growth would continue. That being

so, then it is only right that consideration for the reconstruction of roads and their upkeep should take precedence of all else in relation to the revenue derived from the use of the roads, and there should be the fullest possible preparation for the anticipated development. The two things go much together. There is no lack of labour and material which could be employed on road improvements, with the result that many men could be taken off the dole, and, among the materials required, the gas industry would be happy to dispose of more of its tar and pitch products. At the same time, it is expected that this year will witness a good demand for these commodities for road purposes.

Company Law and Worthless Shares.

The Committee which has been sitting under the Chairmanship of Mr. Wilfrid Greene, K.C., to consider the question of amending the Companies Acts, recently issued their report, which contains important proposals for remedying many defects. The Committee express the opinion that the system of company law and practice in force in England and Scotland meets, in a highly satisfactory manner, the needs of the community at large, and the commercial community in particular; and therefore it should not be altered in any matter of principle, other than where imperatively demanded. Among the amendments proposed affecting matters of principle are the following: Constitution and incorporation, share capital, meetings, prospectuses and "offers for sale," minimum subscription, underwriting commission, directors, management, investigation, fraudulent trading, returns, mortgages and charges, accounts, auditors, winding-up, reconstruction and amalgamation, private companies, companies established outside Great Britain, and share hawking. This is a good list of lines for improvement. We will not go in detail into these matters, other than to say that, in regard to liability for negligence on the part of directors, the Committee hold that, in some cases, quite unjustifiable protection is given, and, in their opinion, the position calls for a change in the law which would not cause any hardship to a conscientious director, or make his position more onerous. On the subject of worthless shares, the Committee regard it as regrettable that frauds of this kind should go unpunished; but they say it is not easy to suggest alterations in the law to protect persons of whatever class who, in the rash hope of large profits, are prepared, without taking advice, to purchase shares in a company of which they know nothing. However, the evil is one against which, in the Committee's opinion, some provision should, if possible, be made; and they submit certain recommendations for meeting it. They, however, suggest that the matter is one to be dealt with by separate legislation rather than by amendment of the Companies Acts. They also propose that the offering from house to house of shares, stock, bonds, debentures, or debenture stock, or similar "securities" of any company for subscription or sale should be made an offence punishable, on summary conviction, by a heavy fine, or, in the case of a second or subsequent offence, imprisonment. The same applies to persons who make offers of such "securities" in writing, and who do not supply a written statement (signed by the offerer) of the prescribed particulars, or who make a statement of such particulars which is false in any material respect. Among the commercial members of the House of Commons, it is considered that the Committee have dealt with the suggested subject of company law and amendment in a very moderate manner. It is also understood there is no prospect of legislation on it this year.

Gas and Electricity Delimitation.

The Walsall Town Council have been discussing the question of the competition between the Gas and Electricity Departments. It arose on various proposed expenditures for the extension of both gas and electricity mains. Our point of view is that, so long as the competition is maintained on a fair basis, little harm can come to gas from the dual supply. The main extensions before the Council were only three small ones. One is to the Palfrey housing site. The extension of the gas-mains to it will cost £435; of the electric cables £1500. Another extension is for electric cables at a cost of £600; and a third gas mains and electricity cables, at a cost respectively of £560 and £520. The chief consideration in the discussion was that the competition would have the effect of reducing from the trading departments the profits available for disposal by the Council. There was some talk, too, of appointing a Special Committee to consider the whole matter, with the view of determining the limitations to be placed on the two departments. Such restrictions might be detrimental to both; and therefore the restricted state would be worse than the free one. We should be very sorry to see any delimitation to gas supply in any area, as that would be unfair to residents who desired the more economical medium. The argument cannot be presented for gas, without, in fairness, doing the same for electricity. This much, however, can be said, that, wherever it will pay electricity to go in a residential or industrial area, it will pay gas to go—for the reasons that transmission costs are much heavier in the total of electricity outgoings than in the case of gas, and that the potential heating value supplied for a given outlay in the case of gas is much higher than in that of electricity. The more capital electricity spends on transmission to the less lucrative areas, the greater become their capital obligations and their electricity losses, and the more attenuated the profits per unit of output. That is a trading advantage to gas, providing the electricity undertaking does not have to come upon the ratepayers for a "dole." The best course for a municipality to adopt who govern both gas and electricity undertakings is to let them develop in respect of distribution and service as their technical administrative advisers recommend. So thought the Walsall Council.

PERSONAL.

Mr. JOHN B. FERNS has been appointed Assistant Manager at the Hamilton Gas-Works. Fifty-six applications were considered by the Town Council.

We learn that Mr. WILLIAM W. TOPLEY, F.C.I.S., the Secretary of the Croydon Gas Company, is retiring on the 30th inst. His successor will be Mr. FRANK F. WOOD, J.P., A.C.I.S. We wish Mr. Topley the best of health and enjoyment in his well-earned leisure.

Mr. D. T. LIVESEY, of Dewsbury, has been appointed Superintendent of the Doncaster Corporation Gas-Works, in succession to Mr. S. O. Pacey, who has lately been appointed General Manager and Engineer to the Retford Corporation Gas, Electricity, and Water Departments.

Recently admitted members of the Institution of Chemical Engineers include Dr. ALBERT PARKER, F.I.C., of Leeds University. Mr. A. R. BISSET, Engineer and Manager of the Douglas (Isle of Man) Gas Light Company, has become an associate member, as have also Mr. J. R. PROBERT, of the Woodall-Duckham Company, and Mr. C. R. WILKIN, of the Bradford Road Gas-Works, Manchester. Mr. S. H. J. BURGESS, of the Gas Light and Coke Company, has been registered as a student.

Mr. A. H. BURTON, the Assistant Engineer and Manager of the Warrington Corporation Gas Department, was recently presented with a handsome bureau and bookcase on the occasion of his marriage. Mr. A. Cook, the Engineer and Manager, made the presentation on behalf of the staff and employees. Mr. Burton, who came from the Meadow Lane Gas-Works of the Leeds Corporation twelve months ago, was married to Miss Nellie Barnes, youngest daughter of Mrs. F. T. Barnes, of Harehills, Leeds, at St. Martin's Church, Chapeltown, Leeds, on April 14 last.

FORTHCOMING ENGAGEMENTS.

June 24.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS (EASTERN DISTRICT).—Meeting at 28, Grosvenor Gardens, S.W. 1, at 2.30.
June 25.—WAVERLEY ASSOCIATION.—Meeting in Edinburgh.
June 29.—NATIONAL GAS COUNCIL—SOUTHERN DISTRICT EXECUTIVE BOARD.—Meeting at 28, Grosvenor Gardens, S.W. 1, at 11.30.
July 13.—NATIONAL GAS COUNCIL.—Meeting.
July 13.—FEDERATION OF GAS EMPLOYERS.—Meeting.
July 19.—INSTITUTION OF CHEMICAL ENGINEERS.—Annual meeting.
July 19-23.—SOCIETY OF CHEMICAL INDUSTRY.—Annual meeting.
Sept. 9.—"B.C.G.A.," MIDLANDS DISTRICT CONFERENCE.—Smethwick.
Sept. 14-16.—INSTITUTION OF PUBLIC LIGHTING ENGINEERS.—Conference at Newcastle.
Sept. 20.—EVENING STAR LODGE.—Emergency Meeting.

INSTITUTION OF GAS ENGINEERS.

June 24.—Wrought-Iron Tubing Inquiry Committee.
July 12.—Emergency and Finance Committees.
July 13.—Advisory Committee on Education.
July 17.—Education Conference.
Sept. 21-23.—Postponed Annual Meeting.
Sept. 24.—Visit to Hastings.

ELECTRICITY SUPPLY MEMORANDA.

THROUGHOUT the discussions which have taken place in connection with the Government electricity plans, there has been, in the references to the matter by Cabinet Ministers, the claim that the Government electrical experts are at the back of the scheme, and therefore the whole thing is sound, and all as it should be. Despite the claim, the Government are confronted by the fact that an overwhelming number of electrical experts who are not in their employ are strongly opposed to the project—not only as originally propounded, but as so far amended by the Standing Committee. Just recently, there has been published in the columns of "The Times" a letter (signed by some of the most representative engineers in the electricity industry, and by chairmen of prominent supply undertakings), which points out that, although the Government have agreed to make certain amendments with regard to the status of the proposed Central Electricity Board, and to constitute a tribunal of appeal, the impression that therefore all is well (which is being encouraged) is not at all justified. When we find the statement attested by such names as Chattock, Devonshire, Garcke, Highfield, Woodhouse, Braithwaite, Sloan, Tegetmeier, and Tuckett, we cannot think the Government will be prepared to say that the professional men represented among the signatories are in any wise inferior in qualification to their own electrical advisers, who are the Electricity Commissioners. The letter from these gentlemen makes plain that they are not opposed to the principle of standardization and interconnection, but they are satisfied that the cost of general standardization of frequency has been seriously under-estimated by the technical advisers of the Government, and cannot be borne by the electricity supply industry without imposing a burden upon the users of electricity. There we have a direct challenge to the technical advisers of the Government; and if such experts are, as they assert they are, satisfied that the cost has been seriously under-estimated, the Government should pause in their interference with the industry, and ask themselves whether all is really well. The letter further states that the signatories are anxious to support any measures calculated to spread the use of electricity, whether by reducing the cost to the consumer or in other ways; but they have grave doubts whether the methods proposed by the Bill will achieve this end. On the contrary, a careful study of the Bill in its present form has forced upon them the conviction that its provisions are inimical to the economical development of electricity supply. There, again, we have a well-considered and deliberately expressed statement which no Government ought to pass by without deep consideration and, if necessary, action. The letter ends with the declaration that, unless the Bill is further amended, it will tend: (1) To diminish efficiency by unnecessary interference with responsible management through duality of control; (2) to introduce further bureaucratic administration without financial responsibility; (3) to discourage enterprise, the terms of compulsory expropriation being unfair to investors, and the prospects of earning a fair return on capital being endangered.

A Grave Warning.

An Example from Norway.

In last week's issue of the "JOURNAL," there appeared a translation of an article published by the "Norwegian Mercantile and Shipping Gazette," which shows how Government interference in the electricity supply of that country has had very disastrous effects. Originally the electricity supply of Norway was run by private companies and municipal and rural authorities; and things went very well then. However, the Government later spent huge sums of money in purchasing the waterfall rights, and that capital is to-day yielding no return whatever. From the statements in our Norwegian contemporary, we gather that the Government purchase of the waterfalls was largely made with a view to the regulation of the price of the water power, so that the Government might exercise control over the economic supply of electricity. The main idea was that the provision of electricity to the whole country should be shaped to one plan, so as to realize the best possible system in the cheapest manner. The conception was no doubt good; but in practice the scheme has not materialized the expectations. As a matter of fact, chaos, instead of organization, seems to have followed; and waste instead of economy. County supplies were developed very rapidly, independent of public control; and there was entire neglect of sound economy by technical co-operation with existing plants—in other words, the construction of new power stations was begun without any consideration of the development which had gone before. Through this, no real co-ordination in practice has been realized throughout the country; moreover, it is found, in the result, that the new power stations, with all they involve, work-out much more expensively than the plant which previously existed—due largely to the experts knowing more of generation than transmission. Our own country appears to be aiming at proving that history can, by Government interference with the electricity industry, repeat itself. Probably, too, what has happened in Norway in respect of the financial issue may also be reproduced in this country. The article in the "Norwegian Mercantile and Shipping Gazette" tells us that the debt for electricity supply in Norway is now something enormous; and the deficits have to be met by the rate and tax payers, while sound finance claims that the charges for electricity should be on such a scale as to meet the total financial responsibility of the supply. Just to mention one case at Aust-Agder, the debt is now at the rate of 531 kroner per inhabitant; while in parts of the country which have not been involved in what is termed the "electricity calamity," the debt at its highest does not exceed 20 to 30 kroner per inhabitant. As the gas industry is a considerable rate and tax payer in this country, we sincerely hope there will be no reproduction here of these lamentable consequences of Government interference.

In Committee.

During the discussion of the Government Bill in Standing Committee, the feeling has grown among the Conservative members that it is a purely socialistic measure. It was Mr. Ramsay Macdonald who not long since said that he laughed and laughed every time he thought of the Bill being introduced by a Conservative Government. There is no question that it suits the Labour-Socialist Party to a degree for which they had never hoped while not holding the reins of office. Many men constituting the Standing Committee are, the more they consider all that the Bill and the scheme involve, impressed with the fact that the first Labour Prime Minister has really something over which to be elated. Among the views which have been expressed by members of the Committee are that the scheme interferes with every existing electricity undertaking in the country, and that no case has been shown for encumbering the electricity supply of this country with the expense and operations of a new department. One of the most singular pieces of self-deception that Cabinet Ministers have unanimously entertained has been repeated in Committee by Col. Ashley, the Minister of Transport. It is that the generation of electricity is to remain in the hands of the existing suppliers; the inference being, which is opposed to the whole scheme, that they are to continue intact as electricity producing as well as distributing authorities, and will as hitherto pursue their functions from A to Z without hindrance or control. The fact is that the generating goal is concentration at sixty or so stations, which means that all the other stations are to be wiped out. The sixty stations will be carried on by those now in possession of the nuclei, but under the regulation of the Board. The whole of the production is to be sold to the Board; to the generating authority will be re-sold the portion which they require for distribution in their own supplying area. According to the Government, this is not control; and there is no interference. It is marvellous how different some people can see things when it suits them to do so. Among the revisions made since our last reference to the proceedings in Committee is one which allows the Central Board to enter into arrangements with any authority, undertaking, or other body without first obtaining the approval of the Electricity Commissioners. During discussion on clause 4, it was made clear by amendments that the Electricity Commissioners are to prepare schemes for the object the Bill has in view, and that the operation of the measure shall not be delayed until a scheme for the whole country is prepared. The schemes to be at once devised will form part of the ultimate whole—in fact, the Attorney-General stated that, if the Bill is passed by the end of next month, the Commissioners hope that the plans for certain areas will be submitted before the end of the year; and these may actually become operative in the early part of next year. The Government accepted an amendment that generating stations operated by railway companies at the date of the passing of the Act should not be taken as selected stations. As a matter of fact, the railways are not at present coming into the scheme. The exclusion was also allowed of any generating stations belonging to any canal, inland navigation, dock, or harbour undertaking, which are operated by the owners at the date of the passing of the Act. Notwithstanding an amendment in his name, referring to the establishing of an appeal tribunal, Mr. Reginald Clarry announced that the gas industry was anxious to co-operate with the electricity industry through the Bill, which remark was much appreciated by members of the Committee. However, at the sitting last Tuesday, the Committee passed an amendment which provides for arbitration, and for the arbitrator being a person "qualified for appointment to judicial office, appointed by the Minister of Transport from a panel to be set up by the Lord Chancellor, or, in Scotland, by the Lord President of the Court of Session, respectively for that purpose."

The Tenant's Right.

An interesting discussion has taken place in the Weymouth Town Council on the subject of whether or not the tenants on the Corporation Westham Housing Estate should have the right to exercise their own free will as to the method by which they should cook their food. The opinion seems to

exist in the Council that the members in their corporate capacity have the right to be autocratic, and to prescribe for the tenants of their houses how they shall perform this very necessary domestic operation, irrespective of whether they lose in economy and efficiency. If it is not a despotic disposition which animates them, then it is clear that the only other reason is that the Corporation—being the administrators on behalf of the ratepayers of an electricity undertaking—are profoundly afraid of the competition of gas. It appears that the Gas Company have received a number of applications from the householders on the estate asking for a supply of gas; and, as a result of a canvass, the Company received ninety signed contracts for gas cookers. Moreover, the Estates and Housing Committee of the Corporation were the recipients of a petition, signed by sixty-eight tenants, asking that permission should be given for gas-cookers to be immediately installed. On the other hand, the Electricity Committee reported that they had twenty-six electric cookers already fixed on the estate; but we venture to suggest that, had there been the alternative gas method available before those electric cookers were installed, a proportion of them would not be there to-day. A canvass by the Electricity Committee secured sixteen applications for electric cookers, whether or not gas was installed, and sixteen further applications conditional on gas not being installed. That tells a tale, as does also the difference between the number of tenants who wish for gas and those who desire unconditionally electricity for culinary operations. In view of this position, the Gas Company addressed to the Council a request to be allowed to instal the gas-cookers required. But the Estates and Housing Committee recommended that the application be not granted. The Company are considerable ratepayers. Why should the Corporation set up a monopoly against a Company who contribute so much to the rates? Why should they suggest that free Britishers should have their wills in this matter of cooking methods bound by the Corporation (who, after all, are merely their representatives, and not their masters) in the way suggested by the Estates and Housing Committee? The decision is really too ridiculous for words. It would be well if the Weymouth Corporation, before taking up such an absurd attitude, would study the decision of the Houses of Parliament in a like matter relative to Newport (Mon.). In the Newport Corporation Bill of last session (see "JOURNAL" for May 13, p. 444), the Corporation sought powers which, in effect, would have taken from the tenants on any property belonging to them the right and liberty to apply, under the General Gas Acts, to the Gas Company for a supply of gas. That liberty is the general law in Weymouth, as in other places. The Company are bound to provide a supply if requested to do so by a tenant, within the conditions laid down by the Legislature. Parliament, however, saw fit not to allow the tenants of the Newport Corporation property to be subservient to the will of the Council in this particular; and therefore inserted the following clause:

> (4) The Corporation shall not make or impose under the powers of this section, any term, condition, or restriction with respect to the form of light, heat, power, or energy to be used in any house, shop, office, warehouse, or other building, or on any lands, or with respect to the taking from any particular local authority, company, body, or person of any form of light, heat, power, or energy.

It would be well if, to prevent such action as was attempted in the case of Newport and Weymouth, that all gas companies should take the opportunity of having the Newport clause reproduced in their next Bills or Corporation Bills in Parliament. However, when the matter came before the Weymouth Council, several hours of heated debate ended up by an amendment being passed, which gave consent to the Gas Company to instal gas-cookers only. That at all events is something gained; but it is not sufficient. There should be no restriction. The economy of the householders on the estate will be much better served, for all forms of heating, by gas than by electric energy at any price at which it can be provided in Weymouth. We hope there will not be much more of this nonsense on the part of municipal authorities. Putting up a claim to the right to rule their tenants in the manner proposed in this case is, to describe it mildly, very ridiculous.

Town Councillors as Shareholders.

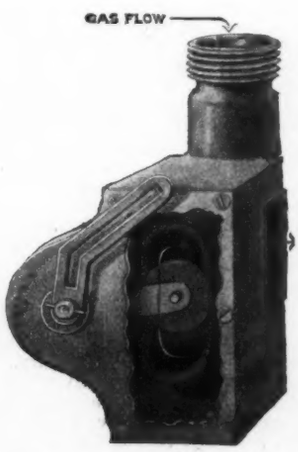
During the discussion referred to in the foregoing paragraph, Mr. Dowell, a member of the Council, was alluding to the correspondence which had passed between the Gas Company and the Corporation on the subject of the supply of cookers to the Westham Estate, when Major Judd asked whether, as a shareholder of the Company, Mr. Dowell had any right to speak. The Town Clerk ruled that he was out of order. Another Councillor, Mr. Biles, also desired to speak. He stated that he was a shareholder in the Company, and asked whether he was permitted to take part in the discussion. The reply of the Town Clerk was: "Certainly not," which was emphatic and laconic. We should like to ask the Town Clerk whether he has studied the decision in the case of *Lapish* v. *Braithwaite* (see "JOURNAL" for Feb. 17, p. 403, and previous volumes). In that case, Mr. Braithwaite was a member of the Leeds City Council; and the action was brought by the plaintiff on the ground that the defendant was disqualified from serving as a member and alderman of the City Council by reason of his shareholding in various companies (as Managing Director of one) who have contracts with the Corporation. The first Court agreed with that submission; but the Court of Appeal and the House of Lords were against it. The Lord Chancellor decided that Mr. Braithwaite was not disqualified under section 12 of the Municipal Corporation Act. Had sub-section (1) of that section stood alone, it is probable he would have been; but sub-section (2) expressly lays it down that a person shall not be disqualified by reason only of the possession of shares or interest in a company. His Lordship said that had Mr. Braithwaite been remunerated by a percentage or commission on contracts, or on profits available for dividend, other considerations would have arisen. Therefore it may be taken that, as long as a gas shareholder is not specially remunerated in respect of contracts, he is in the same position as Mr. Braithwaite. Moreover, in this Weymouth discussion, it was not a contract with the Corporation that was under discussion, but contracts with the tenants of certain houses for the supply of cookers and gas. In view of this and the judgment by the House of Lords, we ask the Town Clerk of Weymouth whether he was correct in depriving Mr. Dowell and Mr. Biles from exercising the right to speak on a matter which affected a Company in which they are merely shareholders. The possession of shares, according to our interpretation of the decision referred to, does not disqualify them from service on the Corporation, and in connection with matters which peculiarly affect their constituents. Unless they are expressly prohibited by the law from opening their mouths on such matters as this, then we maintain that they have as much right to discuss them as any member of the Electricity Committee or other electrical partisans upon the Council. Probably the Town Clerk will not reply to this criticism, though we should much like him to do so.

NEW DEPOSIT-PROOF VALVE FOR PREPAYMENT METERS.

Of the many problems with which the gas distribution engineer has been confronted in recent years, not the least was the collection of deposits in the valves of prepayment meters, which consequently passed gas in small quantities without the insertion of a coin.

Gas meter manufacturers have devoted considerable attention to this deficiency, and Messrs. Alder & Mackay, Ltd., of Edinburgh, have produced an ingenious valve of unique design, which they claim has overcome the difficulty.

As the illustration shows, the gas flows direct to the foot of the valve chamber and rises to the outlet behind the white-metal valve button, which slides over a metal face so that it automatically cleans itself when opening and closing. This new valve is an all-metal production and is incorporated in all the Mark IV. or latest type disc prepayment meters manufactured by them.



It is interesting to recall the fact that Alder & Mackay, Ltd., were the first meter manufacturers to produce a prepayment meter wherein both mechanism and valve were entirely outside the meter top and available for adjustment without interference with the Board of Trade seal.

Institution of Public Lighting Engineers.—Mr. H. Dickinson, City Electrical Engineer and Lighting Engineer of Liverpool, has kindly accepted the invitation of the Council of the Institution of Public Lighting Engineers to give a paper, at the annual meeting and conference at Newcastle in September, on "Some Aspects of Electric Street Lighting in Liverpool."

LARGE CRYSTALS IN SULPHATE OF AMMONIA MANUFACTURE.

Some Contributory Factors.

By H. J. HAILSTONE, A.M.I.Chem.E.

A few months ago an important provincial newspaper (the "Manchester Guardian") published a paragraph headed "The Penalty of Obsolete Methods," which contained the following statement: "The heavy cost that British interests may have to pay for the neglect to keep abreast of the best scientific and technological practice is painfully illustrated in the new report of the British Sulphate of Ammonia Federation for 1924-25. During the past year 57 p.ct. of our sulphate of ammonia trade with Japan—49,000 tons—has been lost because of the tendency of the powdery neutral sulphate exported to cake. The British synthetic product, as it has been pointed out in my notes on the subject in the past, is in the form of a clean pea crystal, the form first developed in Germany. The more progressive bye-product undertakings produce a needle crystal form, but numbers of other works are still content with the old sulphate salt. It is this that seems to explain the loss of Japanese trade; and so serious is the Federation's view of the matter that a special Technical Committee has been set up to improve manufacturing practice."

That this position has been fully appreciated by the sulphate manufacturers of this country is indicated by the number of technical contributions made to the Press of the industry, evidence conclusively demonstrating investigations that have been made, and, indeed, are still being further carried out, by research and other workers on the problem.

It is no longer disputed that the size of the crystals is the prime factor in caking phenomena, just as it is also of very great significance in draining, in neutralizing, and in drying practice. Hence any progress made towards increasing the crystal size of plant output must result in many other advantages besides that of saleableness.

In considering how the production of powdery sulphate may be avoided in typical present-day plants, we shall find it convenient to follow the "life-history" of the individual crystal. This may be divided into four phases: (1) Formation and growth in the saturator. (2) Drainage on table or in whizzer. (3) Neutralization by alkaline liquid or solid. (4) Drying. During phases (2), (3), and (4) the processes in general operation as at present carried out undoubtedly tend to reduction in the size of crystals by solution and by mechanical breakage, though modifications can certainly be devised to obviate the tendency and, if necessary, yield a coarser product than that originally taken from the saturator. A discussion of such methods will be left for a future occasion. My remarks here are confined to the first phase and to the conditions of saturator control responsible for large crystal formation. Since the nature of these original crystals must determine the quality of the products resulting at the later stages of manufacture, a knowledge of their formation is the first desideratum.

SATURATOR CONTROL.

First-hand technical information on the subject of saturator control is very meagre, and beyond the old and oft-repeated instruction to work the bath at a low acidity, little other really useful information has been disseminated during the last two decades. Possibly one of the greatest hindrances to progress in the matter has been the lack of any generally adopted definition of required crystal size—nothing definite seems to have been agreed upon or even suggested; and until this is done, the various producers will be left in the dark. The drawing-up of a suitable specification of crystal size and grade is one of the first requirements. Whether the standard could be generally met or not is another matter, but it would at any rate serve as a goal for manufacturers to strive for, thus inducing efforts which in themselves could only be to the benefit of the industry as a whole.

In briefly reviewing the literature of saturator control, little is found until we get as far back as 1912, when an extremely significant paper by Dr. Lishmann, before the Newcastle Section of the Society of Chemical Industry, is encountered. Among the many variables considered were the temperature and strength of the acid in the saturator; the temperature, dryness, and ammonia content of the ingoing gases; and the amount of water, acid, and mother liquor in the bath as made up. Experimental work on a semi-closed Walker saturator with bottom outlet gave data upon which fig. 1 is based. This shows the modification of composition of the saturator contents as the process proceeds. Points particularly emphasized in the present connection were that the crystals remain suspended until the free acid is reduced to about 8 p.ct., when they commence to settle. The temperature of the bath falls simultaneously with the density, and it should therefore be possible to judge both density and composition from the temperature as observed by a thermometer fixed in the saturator with the scale showing outside—thus advantageously replacing the hydrometer. For the making of "good" salt, it appeared important that the percentage of water in the mother liquor at the commencement of fishing should not be less than 40. This ensures a free boil and means that the acid in the liquor does not exceed 5 or 6 p.ct. If the bath were made up to too high a density, the salt separated out in quantity while the acid was still 12 to 14 p.ct. In this case the liquor was too heavy for the salt to settle, and the whole became nearly solid, and local neutralization and blue salt resulted.

CRYSTALLIZATION.

It may be profitable to deal for a few moments briefly with the existing knowledge of crystallization phenomena. The

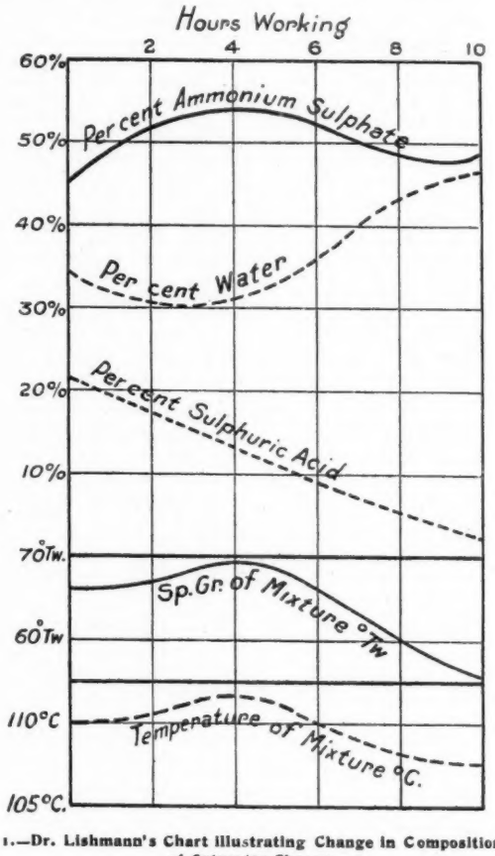


Fig. 1.—Dr. Lishmann's Chart illustrating Change in Composition, &c. of Saturator Charge.

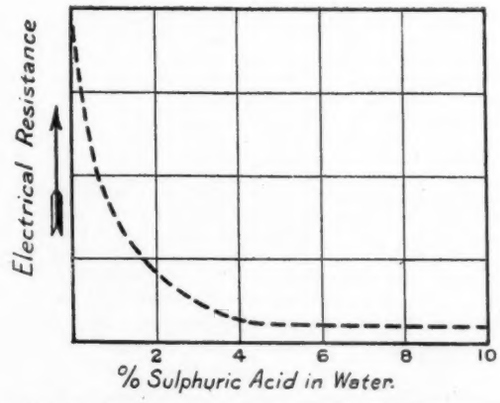


Fig. 2.—Graph showing Increased Resistance at Low Concentration.

position may be roughly summarized in a general manner. The formation of crystals from saturated solutions is a process following certain well-defined laws; and when single substances in solution are being dealt with, the curves representing the solubility and the supersolubility at various temperatures run more or less parallel. The area between these two curves represents a "meta-stable" condition of solution—that is, where crystal growth proceeds—while the region above the line of supersolubility represents a "labile" unstable state where spontaneous crystallization takes place. The latter condition is usually conducive to the rapid formation of small crystals,

whereas the former may be controlled in order that crystals may be developed to the required size.

For many years it was believed that by slow cooling and freedom from agitation the optimum conditions for large crystal growth were secured, but investigations in this field have yielded further data, so that a new technique is gradually being evolved. It has been found that under certain conditions the agitation of the solution is without detrimental effect on crystal growth, in fact the effect is often beneficial; so it is that in recent years agitation of the crystallizing solution has come

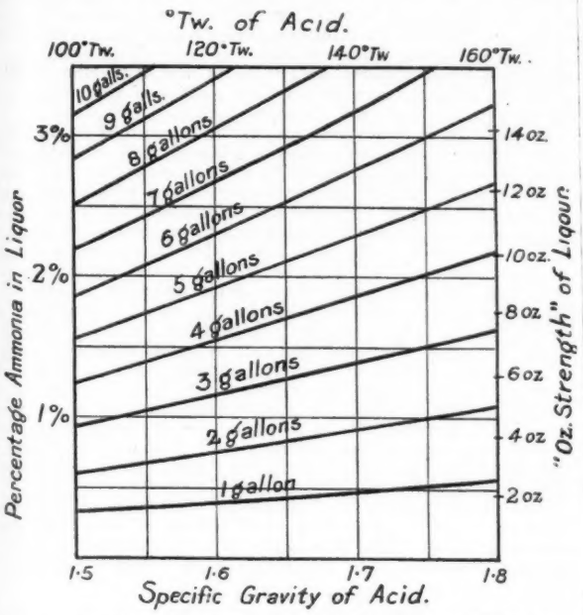


Fig. 3.—Graph giving Gallons of Acid Required per 100 Gallons of Ammoniacal Liquor.

more and more into vogue where graded crystals are required. It is known that increase in temperature has a favourable influence on the rate of growth of crystals and that a definite rate is obtained under certain conditions of temperature and supersaturation. In the words of H. Griffiths (in a lecture before the Institution of Chemical Engineers) "If, therefore, we wish to produce clear individual crystals of reasonable size which have grown, in order to secure a reasonable output from a given size of plant, it is very important that the amount of

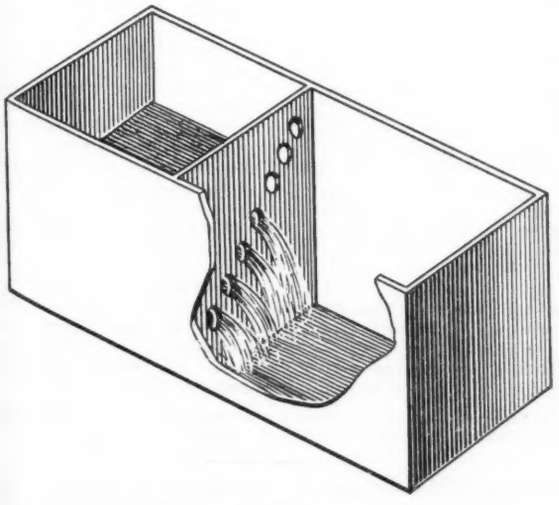


Fig. 4.—Acid-Feed Regulator.

crystal surface presented to the solution shall be adequate. The ideal crystallizing plant for producing grown crystals is therefore one in which the area of crystal surface per unit volume is a maximum, and one in which the rate of cooling or removal of the solvent can be adjusted so that the solution does not reach the unstable region at any time. . . . In order to produce controlled crystallization such as is necessary for the manufacture of individual crystals of even size and regular shape, it is necessary to employ some form of apparatus in which the solution can be brought into contact with a sufficient area of crystal surfaces. It is also necessary that the temperature and concentration of all parts of the solution can be controlled and that the crystals shall be prevented from growing together with agglomerated masses. The ideal plant of this type would be a suspension of crystals not quite touching each other which could be kept immersed in a solution of the correct strength. This, however, is not possible, and we are compelled to use some form of agitation for keeping the crystals in motion—*i.e.*, to prevent them from agglomerating. If this movement be too violent, the crystals will suffer attrition, and large crystals will be difficult, if not impossible, to obtain."

In sulphate practice as ordinarily carried out, presence of an excess of acid is continuously maintained in the saturator in order to prevent the loss of any ammonia along with the waste gases; the only exception being made in the case of the "Bedford" process, where the double saturator permits of working down to neutrality. The general condition of a saturator is one of acidity—decreasing from a large excess to a slight excess where the "batch" system is employed, or of more or less uniformly low degree where a constant feed is provided. In these circumstances the phenomena of crystallization are complicated, since we are here dealing with a heterogeneous system, instead of a simple one. An interpretation of the course of crystallization of sulphate of ammonia from acid solution depends vitally on whether the liquid is stagnant or in free circulation—a point not yet sufficiently well recognized. There exist, however, two schools of thought, one of which was expounded in a recent address before the Coke Oven Managers' Association by G. J. Greenfield, who suggested the desirability of designing saturators in such a way as to allow the crystals to lie comparatively quiescent for a time, before being ejected, so as to allow them to grow. The other view favours free circulation of crystals in the liquor; and in the light of the latest industrial practice in crystal development this must be regarded as the more important of the two.

As has already been mentioned, the neutral sulphate is less soluble than the acid salt, and consequently presence of acid tends to retard the formation and growth of crystals from solution.

Taking the case of a saturator charge which has worked down to (say) 56° Twaddell and containing about 4 p.ct. of free acid, and in which free development of crystals is proceeding, any crystals in suspension are freely mixing with the mother liquor, and their growth continues as fresh combination of ammonia occurs, the average composition of the liquid portion of the charge being only slightly changed during a short interval of time. In this short period the absorption of ammonia, causing formation of sulphate of ammonia and evaporation of some water from the already saturated liquid, induces the deposition of solid sulphate either as a fresh crystal "germ" or as growth to an existing crystal. Owing to the free circulation and the comparatively large proportion of liquid present, the solution remains almost of uniform composition. With regard to crystals which have settled out of the liquid and remain stagnant as a "mush" in an undisturbed situation, not subjected to any marked cooling action, a different state prevails. Here, it is true, the crystals can slowly grow, but only to a very limited degree, for, as they develop by separation of sulphate from the liquor, it will be apparent that this remaining liquor is becoming progressively more locally acid, so that a point of equilibrium is quickly reached where no further crystal growth can occur unless cooling takes place. Unless such cooling is under absolute control, the type of crystal produced will be of a fine nature yielding only powder when subsequently dried. The problem seems to resolve itself into two aspects—first to maintain the correct physical conditions for a sufficient time for crystals to grow, a question of saturator design; and secondly to secure unvarying low acidity, a case for adequate control.

Saturator Design.

Concerning saturator design, for a given output a comparatively large saturator should be of material assistance in maintaining constant conditions, in so far as additions of acid or mother liquor do not so rapidly unduly alter the composition and temperature of the bath, which momentarily prevents crystal growth. A bulky saturator also enables a larger amount of crystallizable material to be kept under growing conditions for a greater length of time than would otherwise be possible. Corners and capacious wells allowing stagnant accumulations of crystal deposits should be avoided, and, if necessary, mechanical or other means provided to ensure a free but not too violent circulation of the mass of crystals throughout the liquor for the requisite period. The modern single saturator is by no means an ideal apparatus for simultaneously carrying out the processes of ammonia absorption, water evaporation, crystallization and circulation, and storage of sulphate, but improvements in design and control are undoubtedly possible. Here is a case for co-operation between plant manufacturers and users in designing a vessel which complies with the requirements enumerated. In exploring the possibilities, many suggestions come to mind—the division of the saturator into two adjacent parts, a reaction vessel and a crystallizing vessel; the use of mechanical agitation for circulating the crystals; employment of controlled heating or cooling devices; the separation and delivery of none but large crystals, with automatic return of "fines" for further growth. The field

for research is unlimited, although some of these channels have already been investigated and numerous patents granted.

Coming to the important factor of control, this largely resolves itself into the maintenance of correct conditions of acidity—the addition of the correct amount of acid, in the best manner, at the right time. So far as most plants are concerned, the control is confined to the periodical Twaddell tests of the saturator liquors; and these rough tests are invariably taken by the sulphate maker. The method has been practised and has held full sway for many years, and it is hard to find any test of a simpler nature which would be of such use. The main criticism to be levelled against it lies in the difficulty of obtaining a really representative sample of the liquor, particularly where open saturators are in use. The open portion of the saturator is not only cooler than the bulk, but it also usually contains a fair proportion of cooler mother liquor running back from the draining table or whizzer. With closed saturators, the disadvantage is not quite so great, but the need for accurate sampling facilities is still marked. The adjustment of the acid feed is dependent upon the correct interpretation of these regular tests, but it is no easy matter to ensure that they are faithfully observed. Attention to other jobs is the excuse invariably pleaded by sulphate makers; and often, it is feared, the saturator contents are left to themselves for longer periods than are desirable. The temptation to run-in a large excess of acid and then leave it to " come to the make " is great. There is here a real need for a continuous indicator or recorder of the saturator acidity, so that the whole of the operating conditions may be followed and checked.

SATURATOR TESTING.

With a view to the replacement of intermittent testing by a recording or indicating instrument, the various physical and chemical methods available have been considered. Automatic density recorders are on the market for meeting similar demands, but so far they have proved inapplicable in this case under the severe conditions to which they are subjected. The violent motion and the accumulation of crystalline deposits make the use of plummets, &c., unsatisfactory. It was seen in fig. 1 that the fall in acidity and density is accompanied by very slight fall in temperature; and though the temperature is subject to minor fluctuations caused by addition of acid or mother liquors, there is just a possibility that greater use may be made of this fact, as suggested by Dr. Lishmann. No further observation on the point seems to have been recorded in technical papers, and little can be said definitely in support of the suggestion. There remain two further physical methods of estimating the acidity, both of which have inherent possibilities justifying a trial.

The first lies in the determination of the refractive index of the bath contents—a method extensively utilized in analytical work generally and of possible application in saturator control. Alterations in concentration of acid and of sulphate bring about changes in the refractivity of solutions. Temperature and crystallizing conditions have a further bearing; and investigation under practical conditions would be necessary before anything definite could be said of this principle as a basis of control.

The second physical method is based upon the observation of electrical conductivity, and this should offer an ideal means for overcoming the obstacles. A method of control based upon this principle was studied by the writer some time ago, and in due course, when the final data have been obtained, the full particulars will be placed before " JOURNAL " readers. As an indication of the principle involved, fig. 2 is of significance. It refers to sulphuric acid solutions (without ammonium sulphate) at 15° C. The sharp decrease in conductivity (*i.e.*, rise in electrical resistance) is particularly marked as the acid content decreases from 5 p.ct. to *nil*; but at high temperatures and with high sulphate of ammonia concentrations several difficulties are experienced.

G. Bolzard has determined the electrical conductivity of such mixtures of sulphate of ammonia and sulphuric acid and water, and has shown that the values vary in different ways depending upon the percentage composition and temperature of the liquid. It is hoped that the difficulties will be overcome, so that a thoroughly trustworthy method may be elaborated. Accordingly the intention is periodically or continuously to measure and indicate or record the electrical conductivity of the bulk of hot liquid in the saturator between two or more electrodes of platinum, lead, carbon, or other suitable material, using any recognized electrical method. These electrodes may be fitted on a single rod placed in the centre of the liquid in the saturator, or may be separately disposed at opposite sides of the vessel. They may be fitted through stuffing boxes or, in the case of open saturators, may be inserted through the space beneath the midfeather. The body of the saturator may be employed to form one of the electrodes. The instrument used for indicating the electrical conductivity serves to show at a glance the degree of acidity, thus enabling the operator to regulate the acid supply and maintain the constant conditions that ensure the production of large crystals. A correction factor may be used to compensate for special conditions of temperature or output.

With a reliable indicator of this type, the difficulties of sampling and testing would be eliminated, and it would not be such a great step further to provide automatic regulation of the acid feed by the same means. This perhaps is looking rather far ahead; much preliminary experimental work must be accomplished before then.

Having lightly dealt with the determination of the acidity, it still remains to review methods for continuously maintaining uniform conditions. This calls for a supply of acid proportional to the supply of crude ammonia entering the saturator; and, to secure this, control of both liquor and acid is necessary, requiring sight feed devices or flow-meters. Variations in the quality of the acid used render additional regulation desirable. As a guide to plant work, Chart 3 has been found useful. It gives the volume of acid of any strength required by liquor of varying strength. Thus distillation of 100 gallons of a 2 p.ct. ammonia liquor requires 4·8 gallons of acid of specific gravity 1·65; or, putting it another way, 100 gallons of 8 oz. liquor require 4·5 gallons of 120° Twaddell B.O.V.

Knowledge of the rate of flow of the liquor thus enables the acid supply to be approximately adjusted, and its maintenance is most simply observed by a lead feed-regulator of the type employed on Gay Lussac towers—a box with a series of holes in the side, so arranged that additional flow is indicated by the number of holes through which the acid runs (see fig. 4).

This regulation of the acid flow within fairly narrow limits is easily accomplished, and the stream should be introduced into the bath at a point where ample agitation is assured. By this means quick circulation will be secured, resulting in equal distribution of the acid throughout the bath and no undue reduction of crystal size such as would otherwise occur where local excesses of acid accumulate. The question of mother liquor and washings returned introduces another complexity, owing to disturbances of temperature and water content. It is possible that improvement might result from the control of its return to the saturator, with a view to minimizing the intermittency of the existing practice. Here is another field for practical trials on individual plants.

Enough has been said to indicate the wide range of problems requiring fuller investigation. The solving of these calls for concerted research and discussion, lest any further " penalty of obsolete methods " be imposed upon the sulphate industry.

NOTES ON NEW BOOKS.

Thermodynamics.*

If, twenty years ago, an aspirant to a responsible position in the control of gas manufacture had, on being asked what were his qualifications, said that he had a good knowledge of thermodynamics, he would probably have been regarded as one of " those theorists "—a man lacking in " sound " practical sense. We do not suggest that gas chemists and engineers should go about the country telling people they have studied thermodynamics; but we do submit that all chemist-engineers in the gas industry benefit by being able to apply to their problems a knowledge of this highly important subject. " Thermodynamics for Students of Chemistry," by C. N. Hinshelwood, renders clear the fundamental ideas of the subject, and explains the methods by which abstract general laws are brought to bear upon the actual problems of physics and chemistry. Throughout the book stress is laid on the interconnection between the laws of thermodynamics and the kinetic theory—the author holding the view that if it were not for the molecular-kinetic nature of things, there is no particular reason for believing that the laws of thermodynamics would be what they are. The volume commences with an introductory chapter in which the aims of thermodynamics in chemistry are outlined, and the first and second laws explained. The next two chapters deal with applications of these two laws. Chapter IV. concerns itself with the Gibbs-Helmholtz theorem, and the remaining sections consider in turn applications of the isothermal reversible cycle, conditions of equilibrium, the foundations of the phase rule, the problem of chemical combination, and entropy and probability. The author naturally assumes that his readers have a knowledge of the calculus.

* " Thermodynamics for Students of Chemistry," by C. N. Hinshelwood, M.A. Published by Methuen & Co., Ltd.; price 6s. net.

Society of Chemical Industry.—The Manchester Section of the Society, with the assistance of Messrs. Provincial Exhibitions, Ltd., propose holding a national exhibition from Nov. 16 to 27, in Manchester, at the City Exhibition Hall, covering coal products, chemical products, and chemical engineering. It is confidently anticipated that the exhibition will receive practical support. It has received the support of the Society of Chemical Industry, the Fuel Section, the Institution of Gas Engineers, the Coke Oven Managers' Association, and other organizations. It is hoped that the Coke Oven Managers' Association will be able to arrange their annual general meeting in Manchester during the period of the exhibition. The Fuel Section of the Society, with the assistance of the Local Section and the Coke Oven Managers' Association, propose to organize a tar symposium, to which all those interested directly or indirectly in tar will be invited to take part.

FIELD'S ANALYSIS, 1925.

WE have received a copy of the above work, the publication of which has been slightly delayed owing to the general strike. The issue deals with the accounts of nearly all the most important undertakings in the kingdom for their respective financial years ending in 1925, and appears in the same form as hitherto—a form to which we have become thoroughly accustomed.

Looking through the pages of the "Analysis," we observe a small, but important, addition to the particulars usually given. It will be remembered that, at a dinner held in the Hotel Cecil in the autumn of last year, Dr. Carpenter (in a speech) suggested that "Field's Analysis" should show the calorific value of the coal gas in each case, so that the number of therms made per ton of coal could be ascertained. This suggestion, we are glad to say, has been adopted by Mr. Ibbs; and on pp. 8 and 18 will be found not only the calorific values of the coal gas but also the calorific values of the water gas made. A word of caution should, however, be given against the indiscriminate use of the figures, as, while such information is undoubtedly a step in the right direction, there are other factors to be taken into consideration before any very definite conclusions can be derived. Where, for instance, vertical retorts are in operation, it will probably be found that the number of therms shown per ton of coal is high; but where, on the other hand, the extraction of benzole is undertaken on anything like a large scale, the therms per ton of coal will appear to be low, unless, of course, the extraction has taken place at the outlet of the holder—*i.e.*, after the gas has been measured—or unless the necessary steps have been taken duly to adjust the figures to allow for the therms extracted.

To give some idea of the divergencies that exist as between the various undertakings, we have, as a matter of interest, calculated the number of therms per ton of coal carbonized from the figures quoted, as follows:

—	Therms Made (Coal Gas) per Ton of Coal.	—	Therms Made (Coal Gas) per Ton of Coal.
The Gas Light	71·19	Bristol	60·58
Commercial	69·85	Derby	61·19
South Metropolitan	72·51	Newcastle	66·93
Brentford	66·10	Plymouth	58·23
Croydon	68·21	Bradford	68·29
Hornsey	69·99	Carlisle	86·36
Lea Bridge	72·26	Leeds	69·82
North Middlesex	68·04	Leicester	76·83
South Suburban	68·18	Salford	69·79
Tottenham	70·52	Widnes	59·68
Wandsworth	68·17	Edinburgh	65·03
Bath	56·71	Glasgow	66·85
Brighton	68·95	Belfast	73·65

To explain away all the differences thus shown, it is obvious that a great deal of detailed information would be required, and of such a character as would not readily come within the scope of the "Analysis." In considering the above figures an interesting point comes to mind, the solution of which would, we are sure, be worth all the trouble involved—viz., as to how far in general practice a high thermal production is financially justified. This is a matter for the consideration of each engineer and manager concerned; and we can therefore leave it for the moment.

Turning to another source of information in the "Analysis," it is gratifying to find that all the undertakings, with the exception of two, have again had increases in sales, despite competition in various directions of which we have recently heard so much. The industry has nothing to fear while it can show such continuous progress. It is interesting to note that the undertakings dealt with represent the sale of a quantity of gas equal to almost two-thirds of the whole of the undertakings in Great Britain; and therefore the progress recorded by these undertakings can be taken to indicate the state of the industry in the whole country.

The figures extracted from the "Analysis" show that the quantity sold by the 35 undertakings for the year was 749,831,291 therms as against 728,366,870 therms in the previous year, representing an increase of 3 p.ct. This increase was due to the larger quantity of gas sold per consumer, and to the very substantial increase in the number of actual consumers, as will be seen by the following table:

Number of Consumers.

—	Metropolitan.	Suburban.	Provincial.	Dublin.	Corporations.	Edinburgh.	Glasgow.	Belfast.
1924	1,461,381	547,107	580,043	61,014	963,560	110,677	301,100	88,035
1925	1,488,809	568,522	597,410	65,006	980,612	111,230	302,008	89,802

Gas Sold per Consumer—Therms.

1924	194·41	174·44	172·22	107·91	157·68	108·08	127·36	161·87
1925	195·24	174·60	174·88	112·05	158·34	110·48	125·31	167·80

Turning to the financial results, and, taking the companies included in the sections dealing with the Metropolitan and Suburban Groups, it is noticed that in a number of cases there has been a reduction in the rate of dividend paid—a state of affairs, however, not yet borne out on reference to the companies included in the provincial group where the same rates of dividend that ruled in 1924 have been maintained. The cause of the decrease in dividends is due to the unfortunate slump in the residuals market at the close of 1924, bringing in its train an almost universal increase in the price that had to be charged in the year 1925 for gas. How serious this slump was can be seen from the following figures taken from the year under review compared with the figures for the preceding year:

—	Price Realized.					
	Coke per Ton.		Tar per Gall.		Ammoniacal Liquor per Butt. 10 oz.	
	1925.	1924.	1925.	1924.	1925.	1924.
	s. d.	s. d.	d.	d.	s. d.	s. d.
Metropolitan Group.	22 6	30 3	3·34	4·03	4 4·49	5 2·64
Suburban Group.	23 5	29 9	2·71	3·85	2 7·26	3 4 77
Provincial Group.	22 6	27 11	3 86	4·65	..	..
Corporations	24 6	23 6	3 45	5·60	..	..

The slump, of course, is not so apparent in the accounts of the municipal undertakings, as their financial year terminates in the early part of the year; and therefore the full effect of the reduction in prices cannot be seen until the next edition of the "Analysis" is published.

Another interesting line of information is with regard to the figures making up the cost of gas. The various sectional costs have been taken out in the case of the larger individual gas companies as well as in that of the gorups of undertakings, and have been computed as a percentage in each case of the

Analysis of Costs in Relation to "Net Gas Rental" for the Year 1925.

Price of Gas (Net Gas Rental per Therm)	Gas Light. d. 8·545.		Commercial. d. 8·866.		South Metropolitan. d. 8·048.		Total Metropolitan. d. 8·417.		Total Suburban. d. 9·683.		Total Provincial. d. 7·452.		Total Corporations. d. 7·470.	
	Per Therm.	P.Ct.	Per Therm.	P.Ct.	Per Therm.	P.Ct.	Per Therm.	P.Ct.	Per Therm.	P.Ct.	Per Therm.	P.Ct.	Per Therm.	P.Ct.
	d.		d.		d.		d.		d.		d.		d.	
Net coal	2·290	26·8	1·978	22·3	1·795	22·3	2·122	25·2	3 353	34·6	2·181	29·2	1·561	20·9
Manufactory charges	2·331	27 2	2·605	29·4	2·468	30·7	2·389	28·4	2·476	25·6	2·006	26·9	2·006	26·8
Distribution charges (less meter, stove, and fittings rental)	0·941	11·0	0·942	10 6	1·163	14·5	1·009	12·0	0·729	7·5	0·784	10·5	1·366	18·3
Rates and taxes	0·685	8·0	0·540	6·1	0·352	4·4	0·575	6·8	0·427	4·4	0 437	5·9	0 747	10·0
Management	0·366	4·3	0·614	6·9	0·524	6·5	0 430	5·1	0·481	5·0	0·422	5·7	0·310	4·1
Co-partnership	0·093	1·1	0 122	1·4	0·203	2·5	0·128	1·5	0·135	1·4	0·053	0·7	..	..
Superannuation	0·152	1·8	0·272	3·1	0·163	2·0	0·163	1 9	0·163	1·7	0·104	1·4	0·088	1 2
National Insurance	0·058	0·7	0·060	0·7	0·075	0·9	0·063	0·8	0·055	0·6	0·051	0·7	0·021	0·3
Other charges (less miscellaneous receipts)	0·030	0·4	**0·016**	**0·2**	0·045	0·5	0·032	0·4	0 124	1·3	0·082	1·1	0·268	3·6
Charge for capital	1·745	20·4	1·678	18·9	1·456	18·1	1·653	19·6	1·615	16·6	1·362	18·3	0·684	9·2
Aid of rates, &c.	..	..	..	..	..	..	..	..	..	..	..	..	0·766	10·3
Surplus or **Deficit**	**0·146**	**1 7**	0·071	0·8	**0·196**	**2·4**	**0·147**	**1·7**	0·125	1·3	**0·030**	**0·4**	**0·347**	**4·7**
	8·545	100·0	8 866	100·0	8·048	100·0	8·417	100·0	9·683	100·0	7 452	100·0	7·470	100·0

"Net Gas Rental." This information will, we are sure, be of interest at the present time, when so much attention is being directed to this particular matter in its bearing on the question of what terms can be fully or partly forfeited when deciding the amount of discount that can be offered to any group of consumers.

It is possible, of course, to continue these extracts at great length; but space does not permit of our doing so. The "Analysis" is open to all who wish to extend their fund of information and knowledge; and we cannot do better than advise that the fullest use be made of the opportunity here presented.

In conclusion, we should like to congratulate the Editor (Mr. H. E. Ibbs) and his staff on having produced for the benefit of the industry the fifty-seventh volume of this most interesting and valuable work, which should be in the possession of all concerned in administration of gas undertakings.

OIL FROM COAL.

By HARALD NIELSEN.

(*Continued from p.* 592.)

It has been mentioned that the oil distillation curves give some clues to the nature of the oils; but going by the curves only is sometimes misleading. It is possible to obtain distillation curves very similar from oil from the same kind of coal but obtained by very different retorting methods, internal and external heating. Examination of the relative specific gravities and ultimate analyses, however, proves the fallacies.

Table IV. (A) (see below) gives the ultimate analyses of the oils from coal 2, Table II. (B), fraction for fraction.

Though the percentage weights of the various oil fractions from coal 2, Table II. (B), and coal 8, Table II. (C)—particularly the higher fractions—are very similar, these fractions are totally different, *vide* Table III. (A).

TABLE III. (A)

Crude Oils. Fractions (Engler).	Specific Gravity D^{15}.	
	Coal No. 2.	Coal No. 8.
0° to 230° C.	0·9540	0·970
230° to 270° C.	0·9830	1·000
270° to 360° C.	1·030	1·080
360° to 400° C.	1·078	1·120
Pitch + loss	24 p.ct.	23·70 p.ct.

See also fig. 1, curves A and B.

The fraction from approximately 330° to about 400° C. in the first column, Table III. (A), is a lubricating oil, while the fraction corresponding in the second column is a resinous decomposition product as unlike a lubricating base as is imaginable.

In fig. 2, curves 1 and 2 give the specific gravities corrected for D^{20}, and represent oils obtained from the same coal—(i) the "L & N" oil as per coal No. 2, Table II. (B), and (ii) oil as per Table II. (C).

Let us for a moment consider the ultimate components of the various oils, primary and otherwise, particularly the neutral oils, the hydrocarbons. It is naturaliy to be expected that a relation exists between the specific gravity and the percentages of hydrogen in the oil. This will be clear by comparing Table III. (A) with Table IV. (A), which latter gives the ultimate analyses of oils obtained from practically identical coals falling within the same Seyler classification—namely, the parabituminous genus.

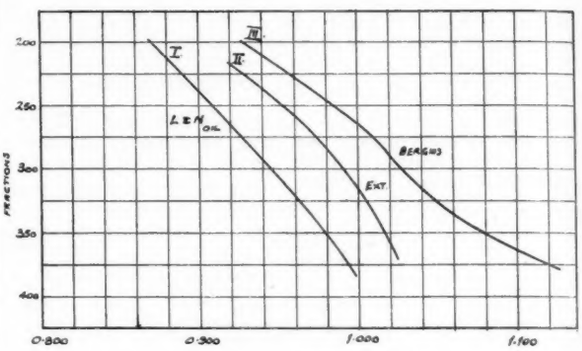


Fig 2.—Specific Gravities of Neutral Oils at 20° C.

Table III. (B) gives particulars of specific gravities of neutral oils obtained by different low-temperature processes where external heat, external and internal heat, and internal

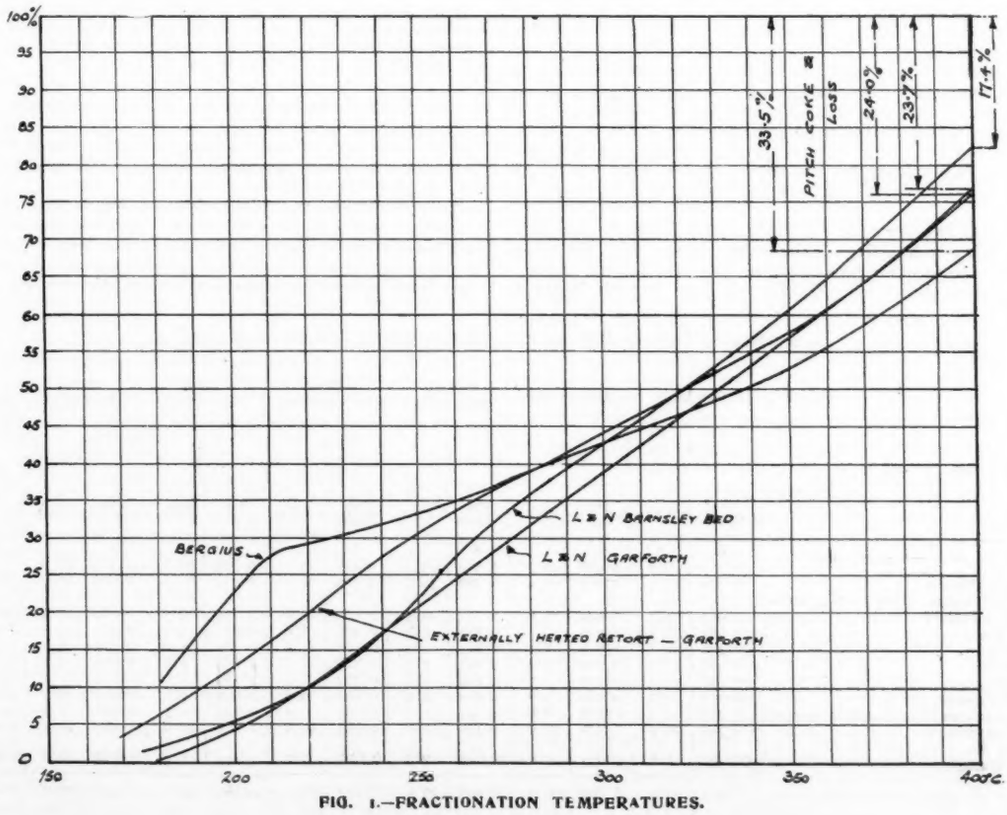


FIG. 1.—FRACTIONATION TEMPERATURES.

heat solely are used. The raw coals employed are of the same genus.

TABLE III. (B).

Neutral Fractions, Engler.	Specific Gravities, D^{20}.		
	Vertical Retort. No Steam, External Heat.	Vertical Retort. 20 P.Ct. Steam. External *plus* Internal Heat.	Vertical Retort. Internal Heat.
170° to 230° C. . .	0·9305	0·9265	0·9315
230° to 270° C. . .	0·9715	0·9645	0·9675
270° to 360° C. . .	0·9925	0·9875	1·0265
Fraction 200° to 300° C. . .	0·9600	0·9555	0·9622
Retort temperature .	650° C.	650° C.	700° C.

A glance at the specific gravity of fraction 200° to 300° C. at once demonstrates that here we have to deal with a mixture of primary and secondary products.

One may be justified in asking why it is that the vertical retorting system with internal heat application does not produce a true primary product. The heating is in counterflow to the coal passage, the operation is continuous, a large volume of gas is present to sweep out the distillation products, and, finally, the temperature gradient should be even. The answer is, first, the medium and high boiling oil fractions condense on the coal in the cold zone, are carried downwards by the coal, and are re-evaporated. This always means a thermal change in the oil, and the formation of pitchy compounds. Secondly, when coking coals are dealt with, it is almost impossible to secure uniform, gradually increasing, heating in the various transverse zones, for the steady flow of gas is interrupted by the coke formation. Consequently, volatile matters imprisoned in newly formed plastic substance are carried down into zones where too high temperatures are prevailing; and the oil vapours escaping are cracked-up. Thus it is generally found that the oil obtained by vertical, internally heated retorts contains a pitch varying from 45 to 65 p.ct. by weight, and is, therefore, not a primary product.

What, then, are the distillation conditions for obtaining a true primary oil? Experience lays down the following rules:

1. Internal heat solely, or, if external heat is used, so large a volume of protecting gas or steam must be admitted that the oils set free do not get into contact with any surfaces or zones of temperatures higher than those at which the oils were evolved in the first instance.
2. The heating must be counter-current to the flow or passage of the coal.
3. The distillation products must be removed in strict uniflow with the heating gas current.
4. Sufficient volume of gaseous heating or protecting medium must be present to lower the vapour tension of the heaviest fractions to such an extent that no condensation takes place within the retort at the temperature prevailing in the coldest zone.
5. Sufficient so-called free space or gas space must be available to secure a free passage of the oil vapours without these being forced to penetrate through colder layers of raw material.
6. Preferential preheating of the raw coal entering to temperatures above the dew-point of the oil vapours.
7. The process of distillation must be continuous.
8. The process must be under complete temperature control.
9. The process should permit modifications in regulation of coal feed, duration of distillation, and volume of distilling medium, independent of one another.
10. The process should be such that the composition of the distilling medium, and the temperature, can be modified and controlled independent of the retorting.
11. The source of heat must be altogether separate from the retort.
12. The largest possible single units should be employed, in order to secure steady running conditions and uniformity of output.

An oil which has been produced under these conditions is the "L & N" oil; and, as remarked above, it is a standard product varying very little indeed from coal to coal. This has been conclusively proved by the distillation on a large scale of many hundreds of tons of bituminous coal of the most varying descriptions.

It is of considerable interest to compare the neutral "L & N" oil with the oil fraction Prof. Bone found was soluble in benzene-free light petroleum from his benzene extract mentioned above—namely, fraction 1.

Bone says:

> Fraction 1 was always a thick, reddish-brown non-nitrogenous oil (with a marked greenish florescence). Its ultimate composition varied very little from coal to coal and approximated that of a hydrocarbon as follows: C 87·9 to 89·7, H_2 8·1 to 9·2, O_2 2·3 to 3·2 p.ct.

The neutral "L & N" oil, Table IV. (A), is, within the experimental limits, to all intents and purposes identically the same as Prof. Bone's. This oil is also a thick, reddish one with a very pronounced greenish-blue florescence, and has a nitrogen content of less than 0·1 p.ct. Whether or not this oil is an actual part of the coal substance which has been recovered intact is difficult to say, but it certainly looks as if it were. When one bears in mind that by the "L & N" process oil begins to be liberated from bituminous coals in nearly all cases at 200° to 220° C., which is 120° to 130° C. below the temperature observed by other investigators (our observations are confirmed by Sinnatt and King), it certainly appears that the pyrogenetic building-up of the hydrocarbon in the "L & N" oil is of a different order to others, if a building-up can be said to take place at temperatures so low. Furthermore, it has been observed in well over 100 assay test cases that at temperatures above 450° C. no further oil evolution from bituminous coal occurs. It has been found that the oils are liberated at temperatures just at or below the observed boiling-points. This must undoubtedly be due to the lowering of the vapour tension of the oil by the large volume of gas. The oils must, therefore, exist at these lower temperatures, or be formed at temperatures at or below their boiling-points.

TABLE IV. (A).

Oil.	P.Ct. Carbon.	P.Ct. Hydrogen.	C : H.	O_2 *plus* Bases.	Remarks.
"L & N" crude oil	88·53	8·85	9·42	7·12	0·5 p.ct. S.
" pitch free oil	83·30	9·24	9·02	6·96	0·5 p.ct. S.
"L & N" neutral oil	87·07	9·97	8·73	2·96	..
" phenols .	77·82	8·07	..	14·11	Refining losses 10 to 12 p.ct. with H_2SO_4
Neutral oils:					
200° to 250° C. .	86·67	11·06	7·82	2·27	Including S.
250° to 300° C. .	86·80	10·56	8·22	2·64	" "
300° to 350° C. .	87·28	10·15	8·60	2·57	" "
350° to 400° C. .	87·71	9·14	9·60	3·15	" "
Above 320° C., phenol and paraffin free .	87·48	8·86	9·86	3·16	0·5 p.ct. S.

TABLE IV. (B).

Dr. Bergius' oil, average crude oil . .	88·35	8·96	9·85	2·65	
Neutral oils:					
200° to 250° C. .	90·20	9·75	9·26	..	Refined oil
250° to 300° C. .	89·50	8·52	10·49	1·98	Not refined
300° to 350° C. .	88·22	7·70	11·45	3·08	" "
Above 350° C. .	91·25	7·15	12·75	1·60	" "

TABLE IV. (C).

Prof. W. Bone's benzene extract .	85·82	6·59	13·05	7·59	Average of four fractions

TABLE IV. (D).

Dr. Bergius' light oils, refined spirit from gas scrubbing	86·70	14·20	6·11	..	NOTE: Totals come to above 100 p.ct.
Up to 180° C. from crude oil . . .	89·33	11·85	7·54	..	

A very remarkable property of the high boiling "L & N" neutral oil is its great thermal stability. For instance, the fraction 350° to 400° C., Table IV. (A), was maintained in an open Engler flask at 345° to 348° C. for four consecutive hours, only showing an average loss in weight of 1·3 p.ct. due to evaporation. This was no doubt caused by the difficulties in obtaining dead cuts without elaborate rectifying columns. There was no sign of thermal decomposition. An examination under a $\frac{1}{12}$-in. immersion objective and Zeiz No. IV. ocular (2500 magnification) failed to discover traces of free carbon, nor had the petroleum ether solubility been impaired in any way. The above test is fairly conclusive as far as thermal stability is concerned, when it is remembered that neutral oils obtained by carefully conducted external heat retorting show a profound change in ether solubility on being momentarily heated to 250° to 300° C. Further, the Fischer fraction over 300° C. from coal No. 5, Table II. (B), was maintained at 280° C. for fourteen hours consecutively; and it was only after this drastic treatment that, on the subsequent petrol ether solubility test, an indication of a precipitate could be found—far too small in volume, however, to permit of quantitative determination.

From the "L & N" high boiling oils, therefore, can be manufactured a lubricating base which will meet all the demands of, and tests applied to, the usual well-oil lubricants. Figures regarding tests carried out at the National Physical Laboratory, Teddington, in comparison with a highly-priced,

well-known oil for ascertaining the static coefficient of friction are given in Table V. and fig. 3.

TABLE V.

Lbs. per Sq. In.	Coefficient of Static Friction.	
	Comparative Oil.	"L & N" Oil.
20	0·129	0·114
40	0·129	0·115
60	0·126	0·116
80	0·129	0·118
100	0·128	0·117
120	0·131	0·116

The value of the coefficient obtained, under the same conditions, for rape oil was 0·080.

Sufficient has now been said regarding the production of a primary oil from coal by distillation.

Independent investigations on the Bergius process have recently been published in "Brennstoff Chemie" (Jan. 15 and March 15, 1926). A short extract of these very carefully and fairly conducted tests are, therefore, of the greatest interest.

Messrs. Meyron Heyn and Manfred Dunkel, of the Silician Coal Research Institute, were requested by the Wenzelaus Colliery, Lower Silicia, to conduct investigations on their coal at the Bergius Rheinau Works (Mannheim); and the results are really the first comprehensive and independent data made public on this highly interesting oil source.

The analysis of the coal they dealt with is given in column 2 in Table I., on the ash and moisture free coal substance, and it will be noted that the coal falls within the same Seyler classification as the coal in column 1.

The test was carried out at Rheinau between March 12 and 14, 1925.

A small Bergius bomb, capable of an hourly throughput of 7 kg. of mixture, was employed.

The mixture was in the following proportions: 20 kg. dry coal (less than 1 p.ct. of water); 10 kg. "paste" oil (Bergius oil stripped to 200° C.); 0·8 kg. "Lux" mass (principally oxide of iron). In all, 118 kg. of mixture was treated.

It is stated that the total oil yield, pitch free, was 25·73 p.ct. by weight on the raw dry coal; on the ash-free coal substance it was 31·2 p.ct. The "berginization" was carried out in the presence of Dr. Bergius' staff.

Heyn and Dunkel enlarge much on the great difficulties they experienced in separating out the unconverted coal, ash, and iron oxide from the liquid matters. They state that a whole week was spent in attempting to settle the oil at 60° C., and they finally had to dissolve the whole distillate above 230° C. in twice its volume of benzole; only after this treatment could the dust be removed. The dust had to be specially extracted by benzole in order to recover any oil carried down with it. Heyn and Dunkel express grave doubts as to the feasibility of efficient dust separation on a large scale (the crude oil carries 34·8 p.ct. of dust). The fractionation, after the removal of the benzole, did not cause any difficulties.

Table VI. gives the fractionation figures of the crude oil.

TABLE VI.

Fraction.	Pressure under which the Distillation was Carried Out.	P.Ct. by Weight.	Corresponding Engler Approximation.
Up to 200° C.	Atmospheric, 760 mm. Hg.	7·2	200° C.
,, 155° C.	15 mm. Hg. *plus* sup. steam	16·3	200° to 250° C.
155° to 180° C.	15 ,, ,, ,, ,,	26·6	250° to 300° C.
180° to 193° C.	15 ,, ,, ,, ,,	17·6	300° to 350° C.
193° to 220° C.	15 ,, ,, ,, ,,	3·8	above 350° C.
Pitch . . .	..	28·3	
		99·8	

The phenol content in the oil fraction, calculated on distillation loss and pitch-free basis, is given in Table VII., together with the specific gravity of the neutral oils.

TABLE VII.

Fraction.	Neutral Oil.	Phenols.	Bases.	Refining Losses of Neutral Oil, to P.Ct. H_2SO_4.	Specific Gravity of Refined Neutral Oil D^{20}.	Remarks.
	P.Ct.	P.Ct.	P.Ct.	P.Ct.		
Light spirit from gas scrubbing . . .	..	..	..	13·9	0·7617	760 mm. Hg.
Up to 180° C. . . .	80·7	18·0	1·3	20·0	0·8238	760 mm. Hg.
180° to 220° C. . .	61·2	34·2	4·6	16·0	0·9161	760 mm. Hg.
Up to 150° C. . . .	81·4	14·1	4·5	20·0	0·9568	15 mm. Hg.
150° to 190° C. . .	89·4	6·1	4·4	19·5	1·0105	15 mm. Hg.
190° to 230° C. . .	90·7	3·2	2·9	48·5	1·0482	15 mm. Hg.
Highest boiling fraction	88·6	0·5	3·5	51·5	1·1208	10^{-3} mm. Hg.
Average p.ct. of crude oil	81·5	12·0	3·8	..	..	(Phenols up to 22 p.ct. have been observed, excluding light spirit from gas.)
Average refining losses in neutral oil	..	..	..	28·7	..	
Fraction 200° to 300° C.	..	..	..	..	0·9790	

The ultimate analyses of the neutral oil fractions and light spirit from Table VI. are given in Tables IV. (B) and IV. (D) respectively. The hydrogen percentages in the neutral Bergius oil in relation to the hydrogen percentages in the neutral "L & N" oil are plotted in fig 4.

Further, the specific gravities of the neutral oils from coal 2, Table II. (B), and coal 8, Table II. (C), as well as the neutral Bergius oil, are plotted in fig. 2, curves 1, 2, and 3.

It will be realized that the fractionation of the Bergius oil was done under the best possible conditions, vacuum and steam, in order to prevent as far as possible any decomposition of the

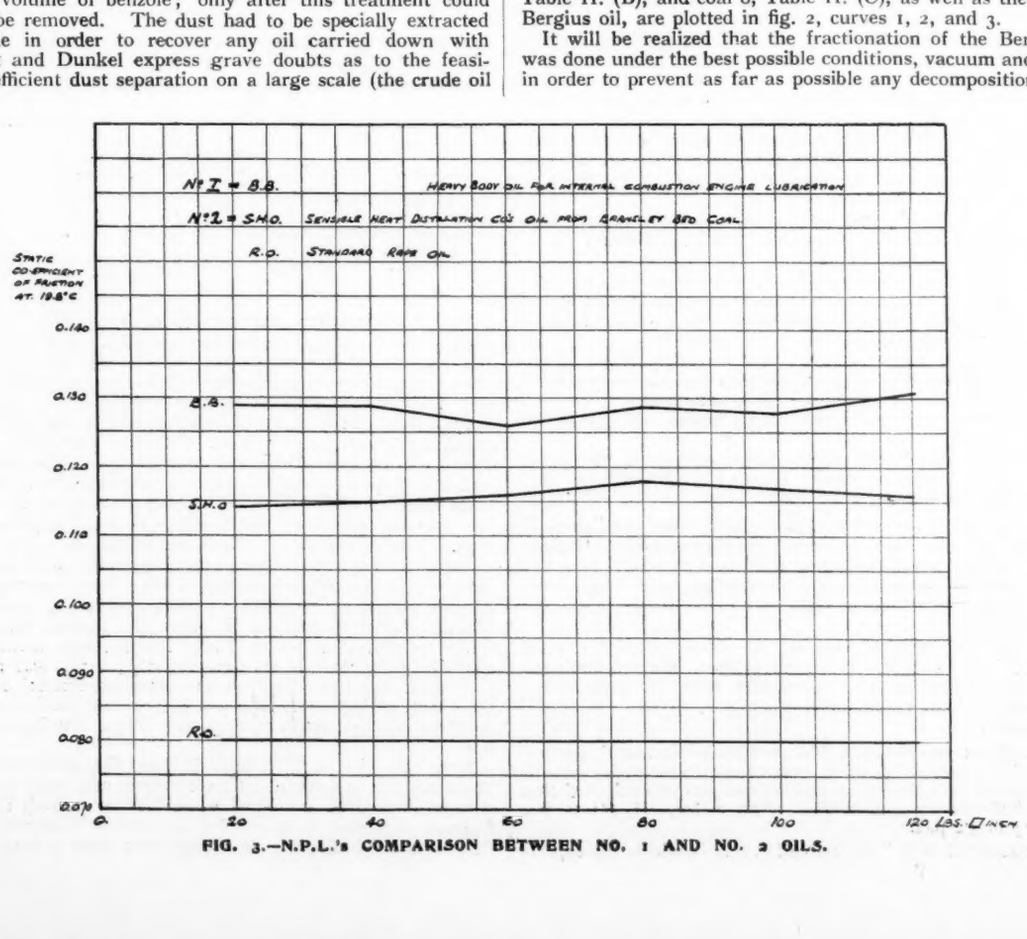


FIG. 3.—N.P.L.'s COMPARISON BETWEEN NO. 1 AND NO. 2 OILS.

oil during fractionation. In order to present a comparison between the Bergius oil and a typical oil from British coal—No. 5, Table II. (B)—an extract from the report on a large-scale "L & N" test is appended (Annexe I.).

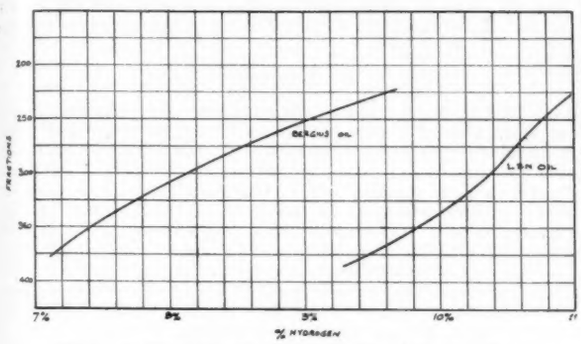


Fig. 4.—H_2 Percentage in "L & N" Oil and Bergius Oil. Engler Distillation of Neutral Oils.

The following conclusions can be drawn from Heyn and Dunkel's investigations on the Bergius oil:

1. The oil yield on the coal substance (ash and moisture free coal) is less than that claimed by Bergius, and aggregates 31·2 p.ct. by weight. The oil is calculated as pitch-free unrefined oil, and includes the phenols.
2. The crude oil contains a high percentage (34·8 p.ct. by weight) of dust, which is extremely difficult to separate out on a small scale, and will cause serious troubles on a working scale.
3. The phenol percentage is high, almost as high as that of vertical retort tar (12 to 22 p.ct.).
4. The ultimate analysis shows that the oils are essentially cyclic and aromatic compounds of benzole structure.
5. The refining losses are heavy (2·5 to 3 times that of a true primary coal oil ("L & N" oils).
6. The percentage of lubricating oil is negligible.
7. In spite of every endeavour, the investigations did not succeed in producing a lubricating oil which could stand up to any of the tests demanded of a good-grade oil.
8. The higher boiling fractions, in spite of extensive refining, are not stable. Polymerization continues to take place, with the formation of gummy substances.
9. The motor spirit fraction does not discolour on exposure to light, is distinctly good, and represents 20 to 25 p.ct. of the oils (including the light spirit scrubbed from the gas).
10. The inference can be drawn that the rest of the neutral oils can only be used as Diesel and fuel oil.
11. The phenols are apparently not hydrogenated to any extent, if at all, in spite of Bergius' former claims.
12. The phenols are principally of the lower series, or, in other words, resemble those found in high-temperature tar more closely than those generally prevailing in low-temperature oils. This is also evidence as to the secondary nature of the Bergius oils.
13. The paraffin percentage is very small.
14. It is clear from the above that from the crude Bergius oil it is not possible to obtain all the various grades required either for national or industrial purposes, as some of the most vital oils are missing.

(To be concluded.)

INSTITUTION OF CIVIL ENGINEERS.

Interesting Display at the Conversazione.

There were many excellent exhibits at the conversazione of the Institution of Civil Engineers, which took place on Wednesday, June 16. Though most of them—including a series of photographs transmitted by long-distance telephone, shown by the International Western Electric Company—were of general engineering interest, several were of particular interest to the gas engineer; and of these a brief description follows.

Special Steels.

A remarkably good selection of exhibits illustrating heat-resisting and non-corrodible steels had been arranged by Sir Robert Hadfield. The first item which claimed our attention was a steel rotor used in the construction of exhaust gas turbines. This rotor is driven by the exhaust gases of internal combustion engines, and works continuously at temperatures from 800° to 900° C. when running at a speed of 30,000 R.P.M. It has, in fact, been run up to a speed of 53,000 R.P.M. for testing purposes, and the peripheral speed was then about 2200 ft. per second. In these circumstances the metal would be almost red-hot; and that it is able to withstand the centrifugal force produced at that speed is a good augury for those interested in gas turbines. The characteristics of the steel of which this turbine rotor was made—which is known as "Era A.T.V."—are demonstrated by tests carried out in the makers' works. These indicate a loss of only about two-thirds of its strength when heated up to red heat. In other words, the maximum tensile stress the material will sustain at normal temperature is 58·5 tons per sq. in., while it is 19 tons at 900° C. It might be contended, however, that, though the steel would withstand such a stress sufficiently long for an ordinary test to be carried out, it would, at these elevated temperatures, become more or less viscous, and tend to creep. Creep-stress tests show, nevertheless, that up to 700° C. at least, the stress which the metal will support indefinitely is as much as 11 tons per sq. in. At this temperature the creep-stress of ordinary 0·3 p.ct. carbon steel is less than 1 ton per sq. in. It is thus obvious that unless a very high factor of safety is demanded, this steel can be used with normal design in circumstances where it will be maintained at nearly a red heat.

A simple demonstration of the non-scaling character of "Era H.R." steel was carried out by heating it in an electric furnace with a similar specimen of ordinary steel to a temperature of 1000° C. under freely oxidizing conditions. The ordinary steel scaled visibly, while the specimen of "Era H.R.," beyond taking a slight tarnish, was unaffected. Bending of the two specimens after cooling shows that the ordinary steel is practically scaled through, while the "Era H.R." can be bent over flat on itself without the detachment of any scale. Many practical applications of this special steel were illustrated by examples of manufactured articles in the form of both castings and forgings. Speciments of recuperator tubes were shown, and indicated that the necessity for resorting to materials of a non-metallic nature, because of their refractory qualities, and in spite of their attendant disadvantages, no longer exists. In the particular case of recuperator tubes, fireclay is commonly employed, notwithstanding its obvious disadvantages as regards both fragility and low heat conductivity. By the use of "Era H.R." steel, strong rigid tubes are obtained, and the prime function of a recuperator—namely, the transference of heat by conduction—is greatly facilitated. Demonstration was also made of pyrometer protection sheaths and tested nozzles for high-pressure gas burners.

Exhibits of "Era C.R." steel showed the resistance of this material to corrosion in sea water and tap water in comparison with other specimens, including wrought iron and 12 p.ct. chromium steel. A series of specimens of the same material exposed to various media, including sulphuric acid (10 p.ct.), acetic acid (B.P.), zinc chloride (1·5 sp. gr.), ammonium sulphate (saturated solution), and magnesium chloride (10 p.ct.), demonstrated its immunity from attack by these reagents. Finally, regarding Sir Robert Hadfield's interesting display, mention must be made of one or two specimens of historical interest in connection with the corrosion problem. There was a facsimile model, constructed in "Hecla A.T.V." steel, of the famous iron pillar at Delhi, erected about 300 A.D., and also iron clippings from the original pillar. A feature of the latter is the resistance it has offered to atmospheric corrosion extending over a period of sixteen centuries. Then there was an iron cramp from the Tomb of Cyrus, founder of the Persian Empire, who died about 528 B.C. Another exhibit comprised nails and bolts from an eighth century Viking ship.

New Bunker Door.

Of considerable interest was a model, exhibited by Ivan C. Barling, of an improved discharging door for coal and coke bunkers—indeed, for any bunkers containing solid material. The inventor explained to us that when bunkers are fitted with ordinary doors there is often considerable dead space, occupied by coal, between these doors; and this naturally reduces the effective capacity. Moreover, he said, if the discharge is rapid, the material is apt to "scaffold." To render the bunker more effective, and to eliminate the tendency of the material to hang-up, Mr. Barling has designed a door composed of a number of sections, which is flexible from end to end—capable of being rolled—but rigid laterally. It was pointed out that this door had a further advantage. It is well known, said Mr. Barling, that the life of any type of conveyor belt—particularly a fabric belt—is greatly prolonged if the material is fed on to it at the same horizontal speed as that at which the belt itself is travelling. It is for this reason that deflector plates are fitted at the bottom of bunkers. With the new door, it is claimed, the length of the deflector plate (and thus the distance the coal has to fall) can be reduced. This is because the slope of the angle of

repose of the coal in the bunker gives to the falling material definite horizontal velocity.

SMOKE POLLUTION.

An exhibit of atmospheric dust and dust counters had been arranged by Dr. J. S. Owens, including a record of dust from the air of the room in which the conversazione was held. The evil effects of smoke need not be emphasized here. In studying the causes and effects of smoke, it is of prime importance to have means of measuring its quantity and ascertaining its nature. Such means have been provided by the instruments designed by Dr. Owens for the Advisory Committee on Atmospheric Pollution. They are manufactured, by the way, by C. F. Casella & Co., Ltd., of London. One of the instruments shown was for measuring the density of city fogs by an automatic arrangement which causes two litres of air to be filtered at regular intervals, through an $\frac{1}{8}$-in. diameter disc of white filter paper. The records obtained consist of dark spots $\frac{1}{4}$ in. in diameter, round the edge of a large paper disc 7 in. in diameter, which latter is divided into 24 hours. The density is read by comparing the records with a calibrated scale of shades from white to nearly black in ten steps. Then there was Dr. Owen's apparatus for dust examination. This apparatus depends for its action on the following principle: When air which contains dust passes through a narrow orifice towards a glass surface, which faces the jet a short distance away, the dust will adhere to the glass, and can be examined microscopically. In the instrument this result is brought about by causing a very fine, ribbon-shaped jet of air to strike a microscope cover glass placed about 1 mm. from a slot-shaped opening forming the jet. The air before entering the slot passes through a damping chamber, and the velocity in the jet is such that a fall of pressure results, thus bringing about a condensation of moisture. The air is then deflected, and the dust, being unable to turn the corner, strikes the cover glass, the velocity of the air falls off, and the pressure and temperature rise, causing the water to be evaporated. The dust is left behind. The settlement dust counter is to enable a true count to be obtained of the number of dust particles or bacteria contained in the air, even when these particles are very coarse. The instrument depends upon the principle of enclosing a definite volume of air to be tested in a small vessel, the height of the vessel being known. The dust in a column of air of this height is allowed to settle upon the surface of a cover glass, where it is subsequently counted. Thus, the area of the base and the height of the column being known, the amount of dust per unit volume of air can be calculated.

OTHER EXHIBITS.

A manometer for use in connection with ventilation, and a portable Pitot tip were shown by J. H. Hodgson and Prof. Douglas Hay. An optical photographic instrument for recording the elastic and plastic properties of metals was exhibited by Prof. W. E. Dalby; and T. Clarkson had a model demonstrating the circulation of water in a thimble tube boiler. Specimens of "Aerocrete" were displayed by Prof. S. M. Dixon; and the Cambridge Instrument Company, Ltd., showed their stress recorder and their vibrograph. The former instrument is for the measurement of stresses in structures subjected to moving loads. Its principal novel feature lies in the method of recording, which does not depend upon optical or photographic methods, and yet is capable of great accuracy. The records are obtained by the action of a moving stylus upon a transparent celluloid film. The pressure upon the stylus is extremely light, and the celluloid flows plastically about the rounded point of the stylus; the line produced having such optical characteristics as to render any point on an enlarged image of the diagram readable to a high order of accuracy. As very small movements can thus be successfully recorded, the moving parts of the instrument can be made small and arranged to move with low velocity, so that even at high frequencies periodic phenomena are recorded accurately and undisturbed by inertia effects. The stylus-on-celluloid method of recording has also the advantage of durability, in that the record cannot fade, and is impervious to oil or water. The vibrograph, as its name implies, is for measuring vibrations of the ground and of buildings and structures generally.

Geissen Low-Temperature Retort.

Some extracts have been taken by the "Engineering and Boiler House Review" from a paper by Herr Kurt Loebinger, read in Berlin, in which the author described a new vertical type of rotary retort for low-temperature distillation, which is being placed upon the market by the Kohlenveredlung-Gesellschaft, and is the invention of the Chief Director, Herr Geissen. For eighteen months an experimental plant has been working satisfactorily with a daily throughput of 25 tons; and the first commercial plant is now being started-up at the Leopold Mine at Edderitz, with units having a daily throughput of 100 tons each. The heating surface of this retort consists of a cast-iron vertical closed cylinder with conical corrugations, which rotates slowly, and is surrounded by a stationary perforated gas-discharge cylinder having conical-shaped guide surfaces. The coal trickles down in the annular space between the two cylinders—falling alternately on the rotating surface of the hot cylinder and on the stationary guide surface of the gas-discharge cylinder. This results in independent banks of coal, alternately stationary and rotating, which are being continuously bedded around the perforations. The gases escape from the free surfaces of the coal banks into external relatively cool accumulators. The retort is heated internally. The coke falls out below on to a rotating discharge shelf. The process is stated to result in an excellent quality tar. The unusually high throughput capacity is obtained not only by the efficient transmission of heat (supplied by a gas burner) to the heating surface, but by the efficient transfer of heat from this surface to the coal, on account of the continuous movement of the latter. The distillation process occupies only some eighteen minutes; and the speed of throughput permits of a retort of very small dimensions.

Safety in Mines Research Board.—One of the investigations of immediate practical importance that is being carried out by the Safety in Mines Research Board is the flame-proof protection of electrical apparatus for use in coal mines. The second report upon this subject, dealing with what they have termed "perforated plate" protection, by C. S. W. Grice and R. V. Wheeler, has just been published (Safety in Mines Research Board Paper No. 21, H.M. Stationery Office, Adastral House, Kingsway, London; price 1s. 3d. net). The experiments carried out have shown that perforated plates complying with an indicated specification will, when used double, allow of a sufficiently rapid release of the pressure developed by a firedamp explosion, and will at the same time prevent the passage of flame. Perforated sheet brass complying with this specification can be obtained commercially. At least two such sheets must be used, one above the other, each having an area of approximately 28 sq. in. per c.ft. of enclosed explosive mixture. The sheets should be placed $\frac{1}{8}$ in. apart. Ingress of dust can be prevented by superposing a sheet of lead foil 0·005 in. thick, which can be protected by a grid of thick wire.

Fuel Section of the Society of Chemical Industry.

As a natural process in the evolution of the Society of Chemical Industry, and as a logical sequence of its activities during the past few years, the formation has been announced of a new Fuel Section, which has the important task of developing the study of all problems relating to fuel technology. The June 4 issue of "Chemistry and Industry" (the Journal of the Society) contains an article from the pen of Dr. E. W. Smith, F.I.C., M.Inst.Chem.E., on the subject of this new Section. He points to the fact that, with the increasing interest that has been shown nationally during the last few years in the subject of fuel, the Society has taken its part in providing a platform for the discussion of special matters of pressing importance in this direction; and the two conferences of last year, at Leeds and Sheffield, were instances of the place which is given by the Society to the subject of fuel. It will, however, be remembered, he says, that, although the Society provided the platform, the conferences were held under the auspices of the Institution of Chemical Engineers, the Chemical Engineering Group, the Institution of Gas Engineers, and the Institution of Mining Engineers; while the Coke Oven Managers' Association took some part in the proceedings. It is intended that the Fuel Committee should be representative of all those interested in fuel among the Local Sections of the Society, together with a leaven of those individuals who are recognized as being the leaders in fuel technology. All members who are interested in the subject of fuel are invited to register themselves as members of the Section, through the joint Secretaries. In addition to other activities, a Tar Symposium is being arranged to take place in Manchester in October or November; and preliminary steps are being taken for a Carbonization Congress in the spring, when it is hoped that the Coke Oven Managers' Association, the Institution of Gas Engineers, and those interested in low-temperature carbonization will co-operate.

"Modern Telpherage and Ropeways."—This is the title of a book by Herbert Blythe published by Ernest Benn, Ltd., at 27s. 6d. net. The volume will be reviewed in a later issue of the "JOURNAL."

Electrical Deflection of Flame.—In a recent lecture before the Chemical Society of Japan, Yuzaburo Shibata stated that it is well known that a flame deflects itself when it is brought into an electric field. This fact can be explained as the result of the migration of the oppositely charged ions in the flame in different directions in the electric field. Differently charged particles can be caught in separate vessels, and analyzed. It is found that carbon dioxide tends to accumulate at the negative electrode. This is attributed to the combustion of positively charged CH, CH_2, and CH_3 ions, formed by the decomposition of hydrocarbons. In the luminous flame, the glowing particles of carbon are positively charged.

SOUTHERN ASSOCIATION VISIT BRISTOL.

These are days when man is not his own master; and events by which members were controlled forced the Southern Association of Gas Engineers and Managers to change the date originally fixed for their visit to Bristol. The invitation to make this visit was, it will be recalled, extended, on behalf of the Directors of the Bristol Gas Company, by Sir George E. Davies, J.P., at the annual meeting of the Association in March, when the Company's esteemed Engineer, Mr. R. Robertson, delivered his Presidential Address. The date then fixed was May 14; but the general strike intervened, and it was put off until Friday, June 18. By this latter date, however, the only change in the situation was a variation in the form of stranglehold which certain sections of the community have sought to maintain upon their fellows; the general strike having given place to a particular strike, little less disconcerting to the gas engineer, to whom coal is the staff of life. These being the circumstances, it was felt that the attendance must suffer, and there were, indeed, some regrettable absences; but that the muster was so large was proof of the popularity of the President and his Directors.

Bristol is fortunately situated, for nowhere can business and beauty be more closely intermingled; while even the smoke that has its origin there is largely profitable, rather than a source of loss. Of both the business and the beauty the visitors saw much during the day. Assembling betimes at the Gas Company's offices in Colston Street, they were welcomed heartily by Sir George Davies, who remained with them throughout the day, the President, and Mr. S. E. Halliwell (Secretary and Commercial Manager). All were delighted to see with them their old colleague Mr. Daniel Irving, who was Engineer of the Company and President of the Association when the members visited Bristol in 1900. Here were guides, philosophers, and friends indeed. Among those who joined the party at this point or at the works were noticed Mr. Charles F. Botley (President of the Institution of Gas Engineers), Mr. H. D. Madden (President of the Wales and Monmouthshire District Institution), Mr. W. M. Mason (Manager of the British Commercial Gas Association), Sir Arthur Duckham, K.C.B., and Mr. H. C. Smith (Hon. Secretary of the Southern Association).

Motor coaches were in waiting to convey the party, by way of the Canons' Marsh and Avon Street Works of the Company, to the Stapleton Road Gas-Works, where some time was spent, under the guidance of Mr. Robertson, who was assisted by Messrs. O. J. Preston, S. Smith, and H. J. Carpenter, the Works Superintendents, and other members of the staff.

One of Bristol's Leading Industries.

The Bristol Gas Company are able to point to a wonderful record of steady progress, which has in it a significant feature—emphasized by Mr. Robertson in his Presidential Address—namely, that the inauguration of the Corporation Electricity Department in 1893 marked the beginning of a definite acceleration in the rate of growth, both of the quantity of gas sold and of the number of consumers; the average annual increments before and after that date being as follows:

	1875 to 1893.		1893 to 1925.
C.ft. gas sold	42 millions	..	67 millions
Number of consumers	310	..	1848

During the luncheon, it was stated by Sir George Davies that in 1890 the Company had 20,500 consumers, and there were 1600 gas cookers in use; while the figures for 1925 were 81,500 consumers and 75,000 cookers.

Statistics for 1925.

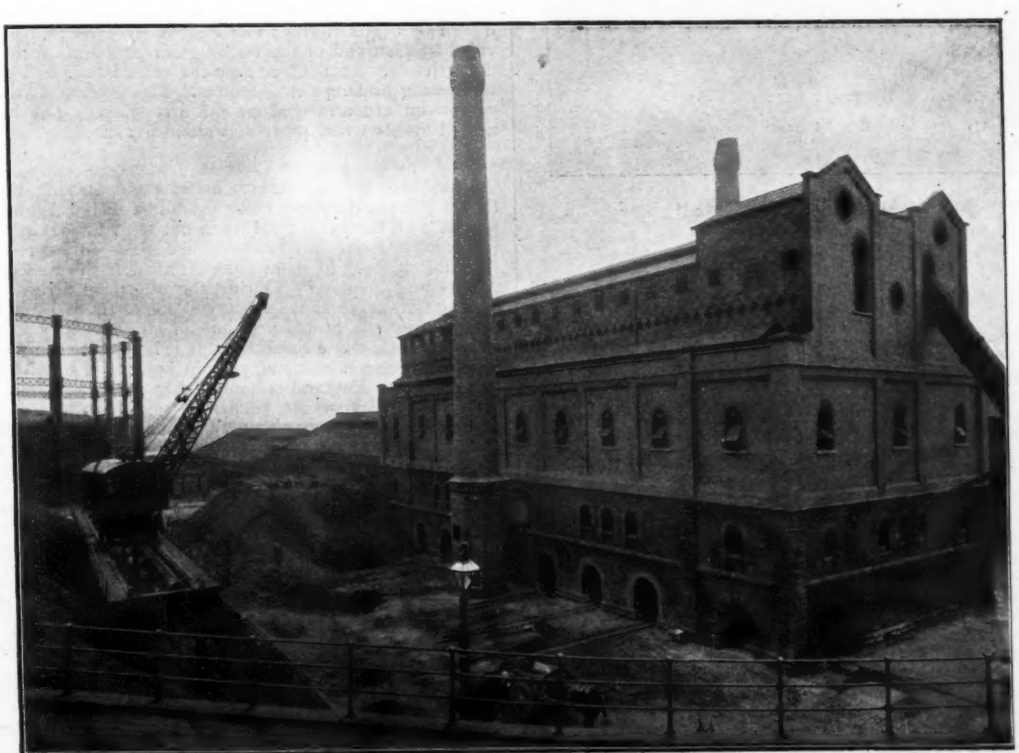
Declared calorific value	480 B.Th.U.
Price of gas	7·375d. and 8d. per therm.
Total manufacturing capacity	18,000,000 c.ft. or 86,400 therms per day.
Total storage capacity	16,000,000 c.ft. or 76,800 therms.
Total gas sold	3,603,127,993 c.ft. or 17,295,014 therms.
Maximum day's sale	15,891,000 c.ft. or 76,276 therms.
Average consumption per ordinary consumer	54,560 c.ft. or 262 therms.
Average consumption per slot meter consumer	29,599 c.ft. or 142 therms
Number of ordinary consumers	44,086.
Number of slot meter consumers	37,464.
Total number of consumers	81,550.
Total length of mains	420 miles.
Average consumption per mile of main	8,578,876 c.ft. or 41,178 therms.

The daily capacities of the Company's three manufacturing stations are: Avon Street, 5¼ million c.ft. or 25,200 therms; Canons' Marsh, 5¼ million c.ft. or 25,200 therms; and Stapleton Road, 7½ million c.ft. or 36,000 therms—total, 18 million c.ft. or 86,400 therms.

Coal gas as an illuminant was first introduced into Bristol in 1811 by a Mr. Breillat, a dyer in Broadmead, who lighted with it his own premises and part of the street in which they were situated. The first Gas Company was formed in 1816, with a capital of £5000. Works were erected at Temple Back; but they were transferred to Avon Street in 1819, and some of the original buildings are still in existence there. In 1823 a rival Company was started, with works at Canons' Marsh, for the manufacture of oil gas. In 1836 powers were obtained to manufacture coal gas as well; and competition between the rival Companies continued until 1853, when the two amalgamated under the name of the Bristol United Gas Light Company, this being changed in 1891 to the Bristol Gas Company.

Avon Street Works.

Coal is delivered by water into the Avon Street Works, and



VERTICAL RETORT HOUSE AND COKE CRANE AT STAPLETON ROAD.

by rail to sidings adjoining. The retort houses are three in number, and arranged in parallel. No. 1 has a bench of nine settings of ten horizontal retorts, each 24 in. by 18 in. by 20 ft. long, equipped with a Gibbons-Guest stoking machine. No. 2 has a bench of ten settings of eight inclined retorts. In No. 3 a horizontal bench is being erected similar to that in No. 1, but with Congdon ascension pipes. The coke-handling plant consists of "D.B." hot coke conveyors in front of each bench, delivering to a common cross distributing conveyor arranged over steel storage hoppers outside. Coke is screened as it falls from the conveyor into the hoppers, and loaded into carts direct from the hoppers.

For ammonia recovery there are three tower scrubbers. Ammoniacal liquor is circulated through the first two, and clean water through the last. Of the two sets of four cast-iron purifiers, one set (with 44 ft. by 25 ft. 9 in. by 6 ft. boxes) is overhead, and provided with a bucket transporter for handling oxide. Both sets are equipped with Cockey centre valve. There is installed a set of 600,000 c.ft. per hour steam turbo-blowers, for boosting the district pressure up to 12 in., and one set of 120,000 c.ft. per hour rotary compressors, driven by reciprocating steam engines, for transferring gas to other stations or district holders at pressures up to 30 in.

The carburetted water gas plant comprises two units each of 1,250,000 c.ft. a day capacity. Blowers in duplicate are driven by De Laval steam turbines; and the tar extractor is of the "P. & A." type. The purifiers consist of one set of four overhead cast-iron boxes with Weck type centre valve and gravity bucket conveyor for handling oxide.

Quenching Benches and Telpher at Stapleton Road.

Canons' Marsh Works.

Here also coal is delivered both by water and rail. There are three retort houses, each containing one bench of 90 horizontal retorts 20 in. by 15 in. by 18 ft. long. Two are equipped with Fiddes-Aldridge stoking machines, and the third with a combined De Brouwer charging-discharging machine. The coke-handling plant consists of "D.B." hot coke conveyors in front of each bench, delivering over fixed bar screens into skips, and thence by electric crane to the storage yard.

The ammonia recovery plant comprises two tower scrubbers and two rotary washers. The latter are in parallel; and the second half in each case is used for naphthalene washing—gas oil being the washing medium. There is one set of four cast-iron purifier boxes, 40 ft. by 36 ft. by 5 ft., and one set of two ferro-concrete boxes, 43 ft. by 31 ft. 6 in. by 5 ft., used chiefly as catch boxes. Both sets are overhead; and the oxide plant consists of bucket elevators and push-plate conveyors. A set of 350,000 c.ft. per hour steam turbo-blowers is provided for boosting district pressures up to 12 in., and one set of 120,000 c.ft. per hour for transferring to other stations or district holders at pressures up to 30 in. A test works includes two settings of five retorts 20 in. by 15 in. by 18 ft. long, with complete equipment for purifying, measuring, and testing the gas.

For the manufacture of carburetted water gas there are two units each of 1,000,000 c.ft. a day capacity; and one set is equipped with a waste-heat boiler. Here, again, the blowers, in duplicate, are driven by De Laval steam turbines, and the tar extractor is of the "P. & A." type. A naphthalene washer of the rotary brush pattern, with gas oil as the washing medium, is employed.

Stapleton Road Works.

There are two retort houses at the Stapleton Road Gas-Works, containing two benches of 20 in. by 15 in. by 20 ft. horizontal retorts, equipped with combined De Brouwer charging-discharging machine and Drake's coke transporter; two benches consisting of sixteen settings of four Woodall-Duckham vertical retorts, 25 ft. long by 13¾ in. by 4 ft. 5 in. mean cross section (with a waste-heat boiler); and four benches of horizontal settings operated by separate charging and discharging machines of the De Brouwer type. Coal (some 50 p.ct. of which is Somerset) is supplied by bucket elevator and band conveyor, and coke is delivered to De Brouwer conveyors in front of the benches, and thence by gravity bucket conveyors to the yard, where it is passed over fixed bar screens. Coke can be delivered from all benches to overhead storage hoppers, with jigging screens of the cascade type underneath, for delivering direct to rail or road trucks.

The ammonia recovery plant comprises a washer of the Livesey type and one of the Cockey pattern, with two tower scrubbers. Purification is now being carried out in two sets of four overhead ferro-concrete boxes 42 ft. 4 in. by 32 ft. 3 in. by 6 ft., with telpher plant for handling oxide. These purifiers were erected some ten years ago, on the site of an old lime shed, the roof of which was removed for the purpose. The telpher passes below the level of the boxes, for the removel of spent oxide; while for loading the boxes the oxide is taken to the centre of the purifier building by the low-level telpher, and then raised to the high-level track and transferred to the required position. It was noted that the station meters are not enclosed.

There are two sets of turbo-blowers, one of 1,000,000 c.ft. per hour capacity for district work and pressure up to 12 in., and one of 250,000 c.ft. per hour capacity for inter-station work and pressure up to 30 in. The steam plant consists of three Lancashire boilers with forced-draught for burning breeze fuel, and one tubular waste-heat boiler on the vertical retort bench. The plant is provided with a water softener; and hot water from the condensers is used direct. Electric power is obtained by two 50 kw. and one 35 kw. generators, driven direct by gas engines.

The layout and condition of the works, as well as the lack of congestion and the open nature of the site, were favourably commented upon by the visitors.

Cooker and Meter Workshops.

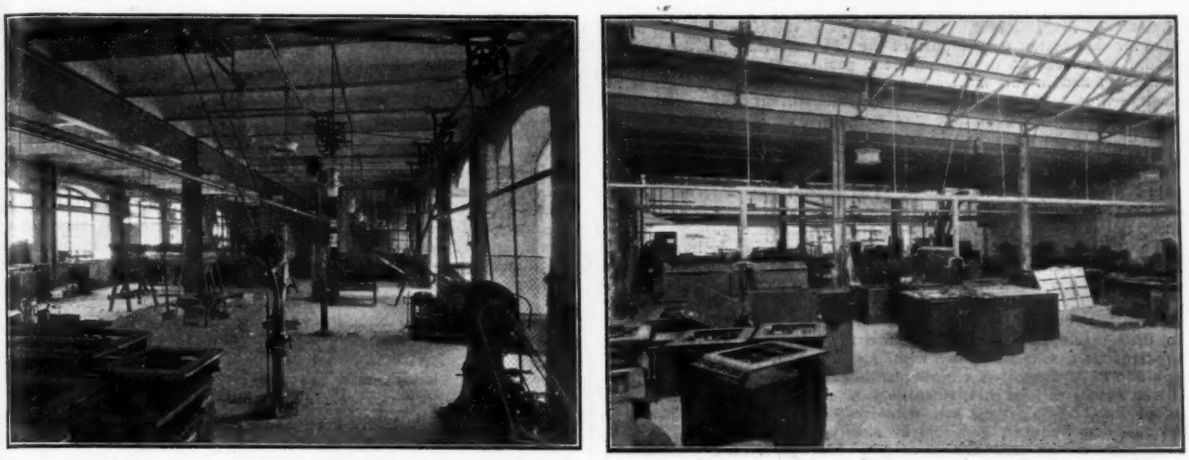
Subsequently there was an inspection of the commodious premises in Barton Street, which have been recently acquired by the Company for their cooker and meter workshops. Here the ground floor is laid-out for the reception of old cookers returned from the district, dissembling, cleaning, and japanning the parts, and then re-assembling, testing, and storing ready for return to the district. The cleaning plant consists of steam-heated caustic soda baths; while japanning is done by hand, and the parts are dried in a gas-fired stove. Machine tools are driven by a gas engine; and electrically driven hoists are provided at each end of the building for communicating with the upper floors. At a future date the second floor will be laid-out for testing and repairing meters. The offices, stores, and report room are arranged on the first floor. The building is heated by hot water pipes and radiators.

Luncheon Speeches.

Many factors combined to make the gathering the success that it was; and among these should be included a fixed determination on the part of the hosts not to be beaten by their own time-table. Even the luncheon speeches—so interesting that the time devoted to them passed like a flash—were concluded "according to plan." During the afternoon drive, one heard on all hands expressions of appreciation of the Bristol Gas Company's generous hospitality, and of admiration of the characteristic speech of the President. If it is true that in many cases Scotsmen come South, and remain here, it is equally true that in many cases England is honoured by them so doing.

As the guests of the Chairman and Directors of the Gas Company, some eighty or ninety sat down to lunch at the Royal Hotel, with Sir George E. Davies in the chair. He was supported by Alderman J. Fuller Eberle (who is also a Director of the Company); but Sir Percy K. Stothert, K.B.E., and Mr. William Windus (Directors) regretted their inability to be present. On the right hand of the Chairman was the Right Hon. the Lord Mayor of Bristol (Alderman Frank Moore), and on his left the President of the Association, and the Sheriff of Bristol. Sir George Davies is also a Director of the Bristol Water-Works Company, whose Chairman (Mr. H. E. Chattock) and Engineer (Mr. J. A. McPherson) were present, together with Mr. H. Faraday Proctor (City Electrical Engineer), the Town Clerk, and other civic officials.

Among those who had forwarded apologies for unavoidable absence were Mr. Thomas Hardie (Vice-President of the Association), Mr. P. G. G. Moon (Immediate Past President), Mr. W. E. Price (Hon. Secretary of the Institution of Gas Engineers), Mr. F. W. Goodenough (Executive Chairman of the British Commercial Gas Association), Dr. T. Lewis Bailey



BARTON STREET STOVE AND METER WORKSHOPS.
Views of the machine shop and the dissembling and erecting shop.

(Chief Alkali Inspector), and Mr. W. T. Dunn (Secretary of the Institution of Gas Engineers).

The Loyal Toast having been honoured, at the call of the CHAIRMAN,

CITY AND COUNTY OF BRISTOL.

Mr. CHARLES F. BOTLEY submitted the toast of "The City and County of Bristol." He was, he remarked, an admirer of Bristol, which he had the privilege of knowing for forty years. The city provided, perhaps, one of the best examples to be found of prosperity and development arising from trade. In the twelfth century a charter was granted to the city. This was followed in the fourteenth century by a more important one; and thus began the period of industrial activity which, in varying degree, subsequently characterized the city. Then at last those wonderful docks were made by the Corporation, which had caused the city's prosperity to go up by leaps and bounds, until he believed at the present time the population was approaching 400,000.

The LORD MAYOR, responding, expressed the pleasure he felt in extending, in the name of the city, a hearty welcome to the Association, the members of which were performing very useful work in providing the community with one of the most essential services of civilized life. He wished them a very successful meeting, and a pleasant time in Bristol.

THE ASSOCIATION AND THEIR PRESIDENT.

Alderman J. FULLER EBERLE (as a Director of the Bristol Gas Company) proposed "The Southern Association of Gas Engineers and Managers," which, founded 51 years ago, had had a highly successful jubilee last year, and was, in fact, the largest of the District Associations. All must agree that the gas industry stood high as one of the essential public services; and it had clearly earned the gratitude of the whole country for the way in which it had carried on—without a break—during the time of the general strike. Had the gas industry unhappily come to a stop, calamitous would have been the result. Those holding positions of great responsibility—like the members of that Association—had spent many anxious hours during that critical time; but the exercise of tact and the maintenance of good feeling had enabled gas-works throughout the country to remain in operation, and had thus prevented the infliction of great hardship upon all classes of the community. It was with great pleasure that, on behalf of the Gas Company, he welcomed the Association to the city. His "young friend on his right"—Mr. Daniel Irving—had just reminded him that 26 years ago the Association had visited Bristol, at which time Mr. Irving occupied the position of President; and those members who had been present on the former occasion, would note the growth of the gas undertaking since that time. He understood the Association had various aims and objects, and he trusted these would be fulfilled, to the welfare and convenience of the community. It was his delight to couple with the toast the name of their President, Mr. Robertson, who was well known and respected by them all in Bristol and elsewhere, as a most careful and capable engineer, a good organizer, and as a cautious and canny Scot whose plentiful supply of quiet humour added greatly to the charm of an interesting and delightful personality. [Applause.]

Mr. R. ROBERTSON said it was his privilege, as President of the Association, to thank Alderman Eberle for the toast so happily proposed, and for the welcome he had extended to the members. While doing so, he would like to associate himself with the welcome, both as a gas official and as a humble ratepayer. That the Lord Mayor and Sheriff of Bristol, with various officers, were present to associate themselves with the welcome, was a mark of the friendly relations subsisting between the gas industry and the public. Bristol was a favourite meeting place for organizations of one kind or another; but none represented a more important service than did the Association who were visiting the city that day. Few industries came into so close a touch with the community as did the gas industry, and none had done so much to reduce labour in the home. Another contribution which the gas industry made to domestic economy had been brought home to them during the present strike, in connection with the storage of fuel. The majority of houses had extremely little storage capacity—some of them had not even a bath [laughter]; but the "fuel bins" of the gas industry, as the Americans aptly termed gasholders, had rendered it possible for consumers without any storage capacity at all almost to forget the existence of a coal strike. Then, of course, the gas industry contributed greatly to the amenities of city and town life, in the direction of smoke abatement. In the amelioration of the evil of smoke, gas had done an incalculable amount of good. Gas, as they knew, rendered national service both in times of war and in times of peace. Next to the problem of food supplies for this country, probably came that of fuel supplies. The national prosperity of this country had been built upon a plentiful supply of coal; and now the coal industry was endangered. There had of late been a tendency on the part of politicians to mix coal and politics; and in this connection, he would like to remind them of a saying of Henry Ford—that what was wanted was less Government in business, and more business in Government. If the Government desired to do anything in this matter, let it be in the direction of more drastic legislation against the wasteful consumption of raw coal in open fires—thereby assisting not only coal conservation, but the welfare of mankind. People sometimes wondered why Scotsmen came South; but if these same Scotsmen thought it held out to them the possibility of being President of such a delightful Association as theirs, of living in so beautiful a city as Bristol, and of serving so excellent a Board of Directors as that of the Bristol Gas Company, then there ceased to be any reason for wonder at their coming South.

THE BRISTOL GAS COMPANY.

Sir ARTHUR DUCKHAM said that to him fell the honour of proposing the toast of their hosts, "The Bristol Gas Company." The members of the Association had been highly gratified with the splendid reception and the generous hospitality that had been extended to them; and their hosts, in their turn, must have felt pleased at seeing so large an attendance, bearing in mind the difficulties of the times. The fact was that the visit had been greatly looked forward to, especially after they had heard Mr. Robertson's Presidential Address. What they had seen that morning, both at the gas-works and at the cooker repair shops, must have convinced them all that Bristol was in the forefront of gas progress. He had known that city for many years. In the old days he had been there to see his friend Mr. Irving, who had given him some difficult work to do. At that time he (Sir Arthur) was young, and had not that intimate knowledge which he was sorry to say he now possessed of Somerset coal [laughter]; but he had never in his life received more kindly treatment or more friendly help than he did in those days. Looking at the works as they now were, they must realize that the progress of the Bristol Gas Company was in line with the progress of the gas industry in general; and they were going ahead as fast as, or faster than, other gas undertakings. While in the vertical retort house that morning, he had seen some of the men who were working there thirteen or fourteen years ago, and they had had an even more cheerful grin on their faces for him than had been the case when he used to come down and see the plant in those early days struggling with the aforesaid Somerset coal. How much of its progress the gas industry owed to the magnificent work done by the National Gas Council and the British Commercial Gas Association, it was unnecessary for him to tell the members of that Association; but there was just one point in this connection to which he would like to draw attention. Had it not been for the two bodies he had named, the industry generally would not have had the assistance of men like Sir George Davies, his co-Directors of the Bristol Gas Company, the Chairmen of Companies and Gas Committees, and others, who had helped them so much. It was the National Gas Council and the "B.C.G.A." which had enabled men like Sir George Davies, Sir William Kay, and Sir Hallewell Rogers to come forward and help the industry as a whole. He would like to see the country generally a little more ready to realize and to acknowledge that the reason why there had been so little trouble over the general strike and the coal strike, had been the foresight and patriotism of the gas undertakings. At the commencement of the coal strike, these undertakings must have had on hand from 4,000,000 to 5,000,000 tons of coal. In other words, those responsible for the carrying-on of the gas industry had sunk their capital in an unremunerative manner simply because they desired to honour their statutory obligations to supply gas. In this way the industry actually must have made an expenditure of from

£9,000,000 to £10,000,000 for the benefit of the community at large. But for this action on the part of the gas undertakings, the country would have been in a very different position for handling the coal situation; and in this matter a great debt was owing to the gas industry—a debt which there seemed little disposition fully to recognize. People were inclined to take gas too much as a matter of course. The industry was one to which they must all feel proud to belong, and one which was ever gaining a more secure position in the economics of this great country. He trusted an opportunity would be taken to simplify gas legislation. The Bristol gas undertaking was extraordinarily happy in its Directors. They were a splendid set of men, the result of whose work had been seen that day.

The Chairman, responding, warmly thanked Sir Arthur for the kind manner in which he had proposed the toast. Continuing, he expressed the opinion that gas and electricity could, and should, be developed side by side, and in a friendly spirit—each recognizing the use that one might be to the other. It was a great satisfaction to the Directors to know that since the advent of electricity their relations as a Gas Company with the Electrical Department of the city had always been of a most pleasant nature. In this connection, it was worthy of note that, since 1893, when electricity was first introduced into Bristol, they had witnessed an enormous extension of its use year by year, and side by side with this there had been a rapidly increasing consumption of gas. In 1890, a little while before the introduction of electricity, the Gas Company had 20,500 consumers, and 1600 gas cookers in use. At the close of last year the consumers numbered 81,500—four times the total of 1890—and there were in use 75,000 cookers; the yearly make of gas being 3900 million c.ft. This afforded convincing support to the suggestion he had just made, that these two great industries were not necessarily antagonistic, but might develop side by side. It was not only the earlier periods that could confirm this. In January, 1924, the Company had 76,000 consumers, and, as he had said, by the end of 1925 this number had increased to 81,500; while the installation of cookers was fully keeping pace with this growth. In this, of course, Bristol did not stand alone; it was typical of what was going on all over the country. He was glad of the opportunity of saying that he, as a Gas Director, fully recognized that to a large extent the success which had attended the development of the use of gas was due to the care and skill exercised by the engineers, who had charge of the technical side; it was due to the improvements that had been made possible by the working of large plants such as those for which his friend Sir Arthur Duckham was responsible; and it was due also to those improvements introduced by manufacturers of appliances, which made gas more convenient and more pleasing in use. While freely recognizing the benefits that electricity was able to confer, they could still claim, without any possibility of argument, that gas remained by far the most economical agent for the distribution of heat. Directors of gas companies must recognize their responsibilities in this matter. They were not Directors of a commercial undertaking in the ordinary sense of the term, who were entitled to make as much money as they could in order to distribute it in dividends. A gas company was a public utility undertaking with definite limitations placed upon it; and he was quite sure that, as long as they continued to recognize their responsibilities in the manner that Parliament considered they should do, the gas industry would go on developing for the benefit of the community.

Clifton, Chelvey, and Clevedon.

The afternoon was devoted to a delightful drive which afforded the visitors ample scope for admiring the beautiful scenery of Somerset. Crossing by the Clifton Suspension Bridge, several old-world villages were passed through, and then there was a pause at Chelvey, to take advantage of an opportunity which had been granted by the Directors of the Bristol Water-Works Company to inspect one of their pumping stations, in which deep-well pumps of old and modern design were seen almost side by side. Then the drive was resumed to Clevedon, where tea was served at the Walton Park Hotel; the return journey being made by the coast road to Bristol.

Before leaving the hotel, a hearty vote of thanks was, on the proposition of the President, passed to the Chairman and Directors of the Water Company; and this was responded to by Mr. Chattock. Similar well-deserved acknowledgment was made, at the call of Mr. Botley, of the debt the visitors owed to Sir George Davies and his colleagues on the Board of the Bristol Gas Company, to the President and Mr. Halliwell, and also to their old friend Mr. Irving. To these thanks were added the fervent hope that the Bristol gas undertaking may continue to prosper as it is doing to-day.

THE LUNCHEON AT THE ROYAL HOTEL.

Gas in the Ascendency.

Comment, under this title, is made in the June issue of "Industrial and Engineering Chemistry" upon figures recently made public by the American Gas Association. The figures quoted are to the effect that approximately 52,000,000 people in the United States now consume gas; and that there are in use 9,800,000 gas stoves, 3,400,000 water heaters, and 4,400,000 room heaters. At present about 400,000 new customers are being added annually. Our contemporary says: "The gas industry has reached its present state of affluence because it has been willing to apply science and to take advantage of any opening made by the application of new facts. A recent example of this is the scrapping by one gas company of a $100,000 ammonia distilling apparatus, and the spending of $250,000 upon a new ammonium sulphate plant. This change was made in recognition of the fact that the fixation of atmospheric nitrogen renders possible the production of a purer ammonia at a lower price than can be made by the distillation of ammoniacal liquor, which is a bye-product in gas manufacture, thus rendering it advisable for this particular gas company to make a product for the fertilizer trade. The activities of the American Gas Association, and of many companies which maintain research laboratories, indicate that in this chemical industry there is still much to be done, and that gas should be looked upon as an industry that is in every sense progressive."

USE OF PURE IRON IN THE GAS INDUSTRY.

[CONTRIBUTED.]

The report of the Sub-Committee of the Iron and Steel Institute on the heterogeneity of steel ingots, and the discussion which ensued when the report was read a fortnight ago at the postponed annual meeting of the Institute, have drawn renewed attention to the perennial controversy as to the relative merits of iron and steel in special circumstances.

The document in question is one the authenticity and good faith of which is beyond challenge. It has been drawn up by a number of eminent men in the employment of firms eminent in the steel trade. It serves to show the practical impossibility of making truly homogeneous steel ingots, notwithstanding that the materials with which it deals range over a wide variety of grades and qualities, including mild steel, which is so extensively used for structural and other purposes. The subject of the report is one of the greatest interest to engineers who are constantly being called upon to decide as to the nature of the material to be employed in special circumstances where the choice is, to all intents and purposes, a limited one, and where the decision is practically confined to the question whether iron or steel shall be selected. The report serves to clear the issues; steel is inherently a heterogeneous material. In some cases this does not matter greatly; in others it is, however, often a controlling factor. Where durability is the primary consideration, and tensile strength a secondary requirement only, the preference will invariably be exercised in favour of the homogeneous material. The reasons for this will transpire later. In the meantime, it is advisable to emphasize the point that, while the heterogeneity of steel is an admitted and incontrovertible fact, homogeneity, in the alternative ferrous metals at the engineer's disposal, is a relative term.

The materials available are cast iron, which has manifest advantages in certain connections too well known to need recapitulation, and, in others, disadvantages which are equally notorious; wrought iron, which is a purer and more homogeneous material than steel; electrolytic iron, which is purer still, but available neither in the forms nor in the quantities suitable for engineering construction, even if it were economically possible to employ it for such purposes; and, finally, "Armco" ingot iron. The latter is, comparatively speaking, a new material which, as was recently pointed out in a report of the National Physical Laboratory, is "the purest iron readily available in reasonable commercial quantities."* It is thus far purer than either wrought iron or electrolytic iron, and is the most homogeneous form of iron known. Where, therefore, homogeneity is a prime consideration, ingot iron is the material which corresponds most closely with the theoretical standard of absolute homogeneity, and displays therefore, to the maximum extent, the advantages which, as will be seen later, attach to homogeneity.

* Tritton and Hanson, "Journal of the Iron and Steel Institute," 1924, Vol. II., p. 91.

INGOT IRON IN THE GAS INDUSTRY.

The conditions prevailing in the gas industry render it imperative to employ, for a wide range of purposes, material capable of withstanding, to an exceptional degree, corrosive influences. The alternative is frequent and expensive renewals, besides the expenditure of enormous sums in maintenance and repairs, painting, &c. The connection between heterogeneity and liability to corrosion is obvious, simple, and well understood. It will suffice here to say that in a heterogeneous material such, for example, as ordinary mild steel, the impurities—which consist of oxide particles, phosphides, carbides, manganese (often in direct combination with the sulphur present), sulphides, and silicides—form galvanic couples with one another and with the iron itself, and lead to accelerated corrosive action, due to the electric currents set up and the accompanying destruction of the "elements" so acting. Hence we find that, in many applications, wrought iron is preferred. The impurities present are admittedly fewer—this being, indeed, a factor in its favour. On the other hand, slag is invariably present; being the characteristic which differentiates wrought iron from mild steel. The slag is, in itself, a potential cause of corrosion, although, broadly speaking, the relative homogeneity of wrought iron is greater than that of the commoner kinds of mild steel in use, and its liability to corrosion correspondingly less.

The report of the Wrought-Iron Tubing Inquiry Committee of the Institution of Gas Engineers, published in the "GAS JOURNAL" on the occasion of the annual meeting of the Institution in 1925, showed that, out of 207 questionnaires received from British gas undertakings on the subject, no fewer than 125 were already in the habit of specifying that for iron piping for internal work beyond the meter only wrought iron was to be employed. A most interesting and instructive table accompanied the report, giving analyses made by the firm of Riley, Harbord, & Law of some eight grades of material, the structure of which was further illustrated by photomicrographs and photographs of specimens subjected to comparative corrosion tests. The table in question shows that the material discreetly referred to in the report as "A," and described as "very pure iron," was by far the purest of the samples under investigation. Another table reveals that it was likewise the most highly resistant to corrosion by syphon water. It emerges elsewhere in the report that this very pure iron was "Armco" ingot iron. Another highly interesting feature of the report is the disclosure that mild steel is sometimes palmed-off on the customer as "wrought iron."

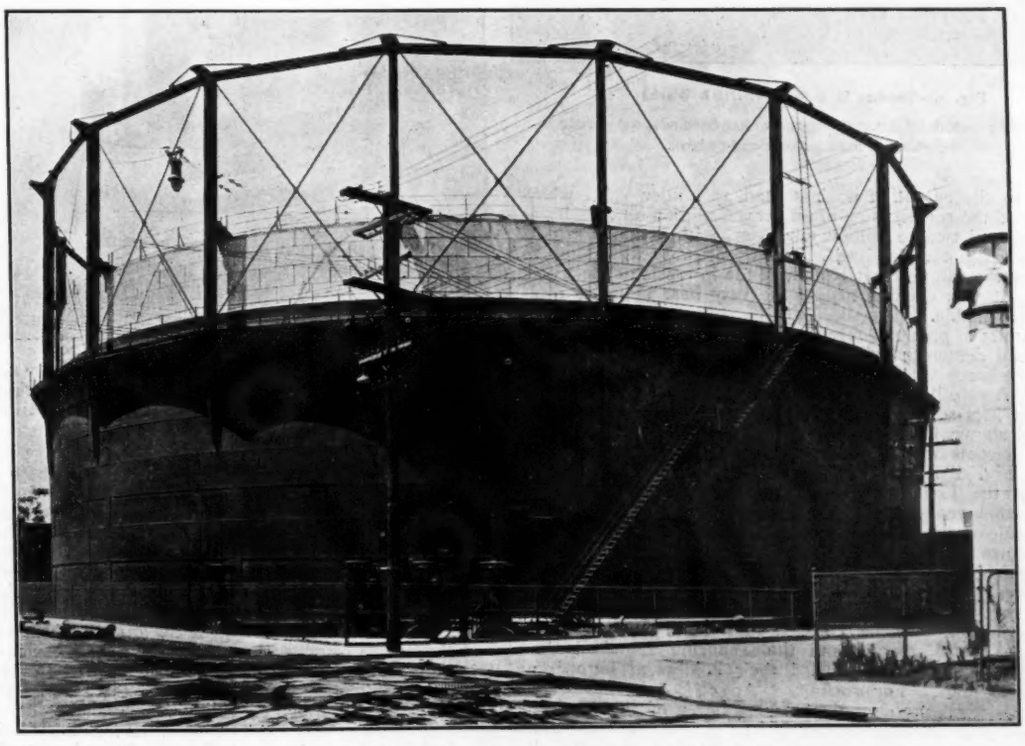


FIG. 1.—1-MILLION C.FT. RELIEF HOLDER AT LOS ANGELES.

The lifts and crowns of this holder were made exclusively of ingot iron, which, as long experience has shown, resists corrosion owing to its high purity and homogeneity.

It would be impossible, within the limits of the present article, to enumerate all the uses of ingot iron in the gas industry. Reference to its employment for pipes and tubes has already been made. In the present inquiry it will be necessary to limit ourselves to the use of the material in a few special instances, wherein its employment has been attended with complete success, and has led, despite the slightly higher initial cost of "Armco" ingot iron, to economies which, in the long run, have shown it to be far cheaper than any other material.

GASHOLDERS AND ROOFING.

It is a tradition, in this country, not always in accordance with actual facts, that American engineering practice favours a low margin of reserve, either in respect of strength or of durability, and that it is the custom of manufacturers in the United States to budget only for immediate needs, and, if necessary, to scrap existing plant and machinery and build anew for future requirements. There is no more in this belief than a half-truth. In a country where development is as rapid, and progress as steady, as in America, conditions change with such frequency that the element of permanence which attaches to institutions in the older European countries obtains often to a lesser degree Americans are, however, far too good business men to adopt any penny-wise pound-foolish policy, and are still less likely to exalt a principle of this kind into a fetish. The ultimate economy which attaches to the use of ingot iron is much too great for them to ignore.

Hence we find that this material is being extensively used in gas-works in the United States, for the construction of holders. Such incentives to build for the present only were abundantly supplied in the case of the city of Los Angeles, which in 1900 had a population of only 102,000, but which, owing to causes that could not have been foreseen at that time, has now become a city of 576,000 inhabitants. The original gas undertakings of Los Angeles were not designed on a hand-to-mouth basis, but obviously they have had to be considerably supplemented. Thus, in 1921 provision had to be made for additional storage

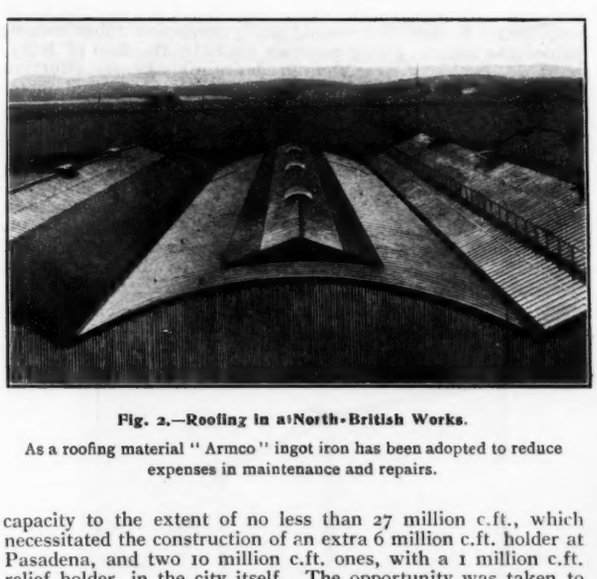


Fig. 2.—Roofing in a North-British Works.

As a roofing material "Armco" ingot iron has been adopted to reduce expenses in maintenance and repairs.

capacity to the extent of no less than 27 million c.ft., which necessitated the construction of an extra 6 million c.ft. holder at Pasadena, and two 10 million c.ft. ones, with a 1 million c.ft. relief holder, in the city itself. The opportunity was taken to budget for the future as well; and, in the interests of the truest economy, it was decided to use the very best material commercially available.

The results of previous experience in the use of ingot iron for roofing had demonstrated its superior merits and led the engineers in charge to specify that in the construction of the new holders "Armco" ingot iron should be exclusively employed for all the lifts and crowns. The experience of some eighteen years had shown its dependability and endurance, and the unqualified success which had attended its use for roofing and gutters. Fig. 1 shows the 1,000,000 c.ft. holder. The engineers of the Los Angeles Gas and Electricity Corporation, writing some years later, make the interesting observation, as the result of comparative tests with this and other material, that "Armco" ingot iron has a much longer life than other brands which had previously been in use.

European experience has endorsed this finding; and, to come nearer home, a number of British gas companies have adopted this material for their own needs. To name only two, the Eastbourne Gas Company and the Tendring Hundred Gas Company, Ltd., have constructed their holders of ingot-iron plates throughout. For roofing, "Armco" iron has likewise shown itself proof against the vagaries of the English climate and superior to other descriptions of iron and steel, and has, in consequence, been adopted at a number of works all over the country (fig. 2). The roofing of the purifier sheds at the East Greenwich Works of the South Metropolitan Gas Company is made of this material, and affords another example of its many applications for purposes where severe conditions have to be met in service.

Before turning to another aspect of the use of ingot iron in the gas industry, it may be pointed out that the homogeneity of ingot iron renders it a peculiarly excellent base metal for galvanizing and tinning. Galvanized fencing is much used in and around works; and here, again, the truest economy is to employ the best material. Constant repairs are costly; and the margin between the price of fifth-rate wire and wire which will last for years will save the cost of such repairs many times over.

DOMESTIC USES.

The use of enamelled ware for domestic purposes is one of rapidly increasing interest and importance to all gas supply undertakings. Enamel on iron serves a twofold purpose—protective and decorative. An enamel which fails to adhere, cracks or "crazes," and peels or flakes off, is neither protective nor decorative. As is well known, corrosion is apt to occur to an accelerated degree at the surfaces exposed by such defects, although not, perhaps, to the same extent as when tin or zinc plating breaks down in service, whereupon intensified galvanic action takes place, accompanied by severe corrosion.

Gas undertakings rely enormously on enamel in the domestic

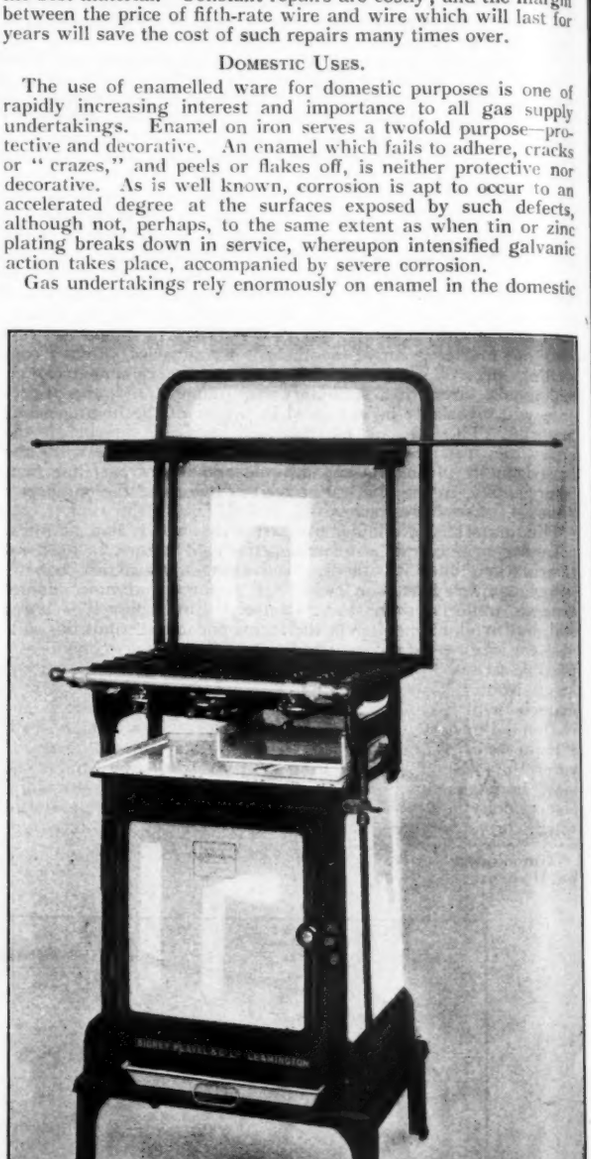


Fig. 3.—Gas Cooker with enamelled parts made of "Armco" ingot iron. Enamel, plating, and pigments adhere far better to the smooth homogeneous surface of such material.

and household fittings and accessories they supply; and it is in this connection that the selection of a suitable base metal becomes a matter of such paramount importance. In these days of competition, it is more than ever necessary to secure both the maximum protection and the maximum decorative effect, and to avoid giving the customer opportunity for invidious comparisons or for disparaging remarks. This is a point which deserves the closest attention; and it will be well, therefore, briefly to recapitulate the scientific relation which exists between the purity, or, in other words, the homogeneity, of the base metal selected and the degree of adherence of the coating employed—whether this be a plating, such as tin or zinc, as in the case of much domestic hardware; an enamel, as in the case of stoves and cookers and a number of culinary appliances; or, finally, a paint, as in the case of exposed ironwork for which a pigment is required both for protection and to mask the bare ugliness of a plain metal surface.

In the case of metal coatings, two factors intervene. Take, for example, the case of zinc. Pure iron has a much smaller

tendency to alloy with zinc than steel; impure iron and steel dissolve very much faster and to a far greater extent in molten zinc. The result is that the zinc coating is far more contaminated with iron. From this fact flow certain consequences of importance. The difference in potential between commercially pure iron and its coating is less than between impure iron and zinc. The impure zinc coating may, in itself, become a cause of galvanic action. The other factor is that any coating actually adheres far better to a homogeneous metal than to a heterogeneous metal. Differential adhesion occurs—a function of many things, among which surface tension phenomena play no small part, complicated by the presence of occluded gases, &c., which not only accentuates the differential adhesion, and so causes scaling, but may lead to the formation of local pitting; "pinholing," and blisters.

The same considerations apply, *mutatis mutandis*, and, so far as corrosion is concerned, to a lesser degree, but, in respect to cracking, blistering, and other flaws, in nearly equal degree, in the case of enamels. The uniformity of the texture of a pure iron surface, its open grain, and its lower tendency to warp and become distorted—fertile causes of cracking, "crazing," and flaking in the case of other ferrous materials—enable enamels not only to adhere more closely, but to adhere so closely and so compactly that these defects do not occur at all. It has been found in actual practice that, apart from these positive advantages, there is a maximum development of the properties of lustre, purity of tone, and beauty of colour when ingot iron is employed as a base, which renders it an ideal material for the many purposes for which enamelling is employed either in industry or in art. For such purposes, therefore, it is manifestly an advantage to specify the use of ingot iron, and to avoid the less pure and more heterogeneous materials such as wrought iron and mild steel, which do not enamel nearly as satisfactorily. The consideration may appear a small one, but it is none the less important. In these days of intense competition, it is the small considerations which sway the balance.

Fig. 3 shows a gas cooker the enamelled parts of which are made of "Armco" ingot iron, which is being employed for many purposes of a similar description. Testimony is forthcoming that the results are eminently satisfactory, and that much waste is avoided, and the unremunerative and vexatious production of "seconds" in ware of this kind becomes reduced to a negligible quantity, when care is taken to specify that, for articles which are to be enamelled, ingot iron is to be used as the base.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

(Auxiliary Section Meeting.)

The Half-Yearly Meeting of the Auxiliary Section of the North of England Gas Managers' Association was held on Saturday, June 19, in the Recreation Room at the Water-Works of the Hartlepool Gas and Water Company, Middleton Road, West Hartlepool. Mr. C. G. BARRETT, Assistant Engineer and Manager of the Hartlepool Gas and Water Company, presided as Chairman of the Section.

CHAIRMAN'S ADDRESS.

I would like to express my thanks to the members of the Auxiliary Section for the honour they have conferred upon me in electing me Chairman. It is a difficult position to fill, when following such an eminent Chairman as Dr. G. Weyman; and if I could hope to fill the position as worthily as he has done, I should be more than satisfied at the end of my term of office. I am not in a position to speak from practical experience of apparatus which is particularly novel; but there are two or three recent additions in connection with our carburetted water gas plant which are not as yet in very common use, and I hope therefore the particulars I propose to give may prove of interest.

WASTE-HEAT BOILER.

Two years ago it was decided to instal in connection with the Company's water gas plants at No. 2 gas-works a waste-heat boiler of the type now in operation on a number of water gas plants in this country and America. It was supplied and erected by Messrs. Humphreys & Glasgow, constructed in one section, and combined with the existing blue water gas plant; the combination forming one section of self-steaming blue water gas plant.

The water gas is passed through the boiler, as well as the blast gases, and renders the plant entirely self-dependent for steam, with some surplus. The attention required is given by the gas makers as a part of their routine water gas operating, so that it eliminates not only the whole cost of boiler fuel, but a certain amount of boiler house labour, including the handling of fuel and ashes. Ignoring the saving in labour, and considering only the saving effected in coke fuel, it amounts in the Company's case on the last twelve months' working of the plant to about 1283 tons, or over £1600 at the prices realized for coke sold during that period. The initial cost of the boiler, &c., was high, on account of the special design, and as it is perforce a tubular boiler. Delivered and erected complete with water softening plant, it cost slightly over £4000.

But, in addition to the economy in fuel effected by its installation, there was another aspect in the Company's case which justified its adoption. The Company have two plants for the manufacture of carburetted and blue water gas respectively; the total capacity amounting to 1,600,000 c.ft. During the winter months both these plants are worked for about twelve hours a day; and before the installation of the waste-heat boiler it required both the existing Lancashire boilers in operation in order to generate the quantity of steam necessary, the result being that there was no spare boiler in the event of any breakdown of either. The feed water also was hard, and the boilers had to be run for longer periods than was desirable before there was an opportunity to lay them off for cleaning; so that, apart from the question of the preventable loss of fuel, there was the fact to consider that if the water gas plants were to continue in operation to the same or an increased extent in the future, there should be provided additional steam-raising plant.

When a waste-heat boiler, as in this case, saves the installing of an additional Lancashire boiler, its cost, including setting, fittings, connections, building, and foundations, should be deducted from the cost of the waste-heat boiler plant, and only the capital charges on the difference in cost be set against the savings effected. The installation of a waste-heat boiler, therefore, has put the Company in the position of having a spare Lancashire boiler available in the winter when both water gas plants are in operation, and as will be evident has also effected an important economy.

It is hardly necessary, I think, to enter into a detailed description of it, as I hope you will take the opportunity this afternoon of inspecting it for yourselves. It is of the upright multitubular type, having a blow-off pressure of 115 lbs. per sq. in.; the steam pipes being linked-up with those from the Lancashire boilers, which have a blow-off pressure of 110 lbs. per sq. in. This arrangement allows the excess steam generated during the blow to pass back into the works boilers for temporary storage and subsequent use during the "run," and thus be saved instead of blowing to waste. By having the blow-off pressure of the waste-heat boiler above that of the ordinary boilers, the water gas operator can give his attention to the production of the maximum amount of steam obtainable from the blast gas, while the ordinary boiler firemen confine their firing to whatever supplementary amount is necessary to maintain the steam supply. We find that the difference of 5 lbs. is sufficient to ensure that no wastage of steam occurs at the valves of the waste-heat boiler.

The boiler itself consists of a main cylindrical shell, inclined slightly from the vertical, containing the top hot-gas outlet chamber and the water compartment, which is formed between the upper and lower tube plates and the hot-gas tubes, and of a lower vertical cylindrical portion containing the gas inlet chamber. The steam drum and down pipe are situated vertically alongside, and bolted to the main shell. A recuperator is placed between the generator and the boiler, and is fitted with fire-block lining and non-conducting lagging, and filled with firebrick checker-work, similar in every way to the carburettor of the carburetted water gas plant. A temperature of 1300° to 1400° Fahr. is maintained in the recuperator, and materially assists the hot gases in carrying forward their heat to the boiler.

The makers provide very full and lucid instructions in reference to starting-up and operating, which we have experienced no difficulty in carrying out; but probably the most important point to observe is to avoid undue "forcing" when starting-up. A cold boiler should never be forced, and sufficient time should always be allowed for the heating to be gradual, so as to avoid letting undue heat reach the tube plate until it is steaming.

The secondary air blast is provided for burning the combustible content of the "blow" gases issuing from the generator. This should never be used to burn the water gas made during the steam run, as the water gas flame is much hotter and more local in its effect than the long "soft" flame of the combustible CO of the "blow," and it might cause overstraining of the boiler tubes or overheating of the checker-work. In our case, working the water gas plants in the day-time only, we were afraid we might have trouble with the tubes, due to the constant starting-up and shutting-down; but so far all is well.

Another most important point is to see that the feed water is free from scale-forming salts and suspended matter liable to form sludge or to cause priming; otherwise with a boiler of this type trouble is bound to ensue, and very soon. We there-

fore installed a water-softening plant, of which I will speak more particularly later. We find in practice it is better not to reduce the water to zero hardness, as the action of the water on the fittings and gauge glasses is very erosive, the latter having to be renewed weekly; and, in addition, zero water causes priming.

WATER-SOFTENING PLANT.

As already indicated, on account of the character of the water it was necessary to instal a water-softening plant in connection with the waste-heat boiler. The Company, as you know, are responsible for the water supply of the district; and the position is somewhat unique, as a dual supply is provided, in two separate systems of mains. The domestic supply is direct from the magnesia limestone, raised from boreholes upon the site of the pumping station, and is a brilliant, pure, and most excellent potable water. But excellent as this water is for domestic purposes, it is not suitable for steam raising, owing to its hardness; and a trade water is therefore furnished from impounding reservoirs at Hurworth Burn, Crookfoot, and Hart, which lie within a radius of some 8 or 9 miles of the Hartlepools. Owing to surface springs on the gathering ground, even this water is somewhat hard, containing 13° temporary and 7° permanent hardness on Clark's scale.

As everyone may not be familiar with what is meant by the terms hard and soft water and temporary and permanent hardness, perhaps I may be permitted to give a brief description. With some natural waters, soap behaves in the same way as with distilled water, and gives a good permanent lather, but no curd. Such waters are free from calcium and magnesium salts, and are designated soft waters. Many natural waters, however, contain one or more of the following salts:

Group 1	Calcium hydrogen carbonate	$Ca(HCO_3)_2$
	Magnesium ,, ,,	$Mg(HCO_3)_2$
Group 2	Calcium sulphate	$CaSO_4$
	Magnesium ,,	$MgSO_4$
	Calcium chloride	$CaCl_2$
	Magnesium ,,	$MgCl_2$

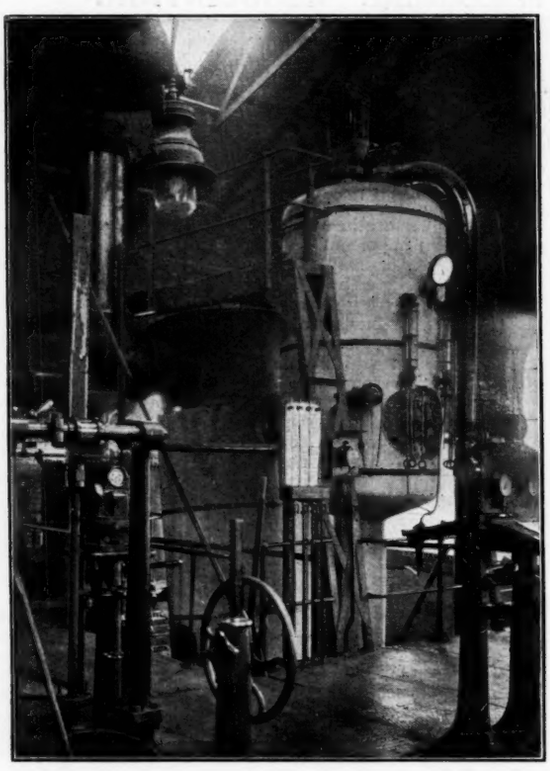
All such waters give, with soap solution, curdy masses instead of a lather, and are described as hard waters. Hard waters, however, differ in behaviour according as they contain salts of Group 1 or Group 2. The salts of Group 1 are decomposed when the water is boiled, and are precipitated as insoluble normal carbonates, so that when the boiled water is poured off from the deposit it is quite soft, and gives a clear solution and a permanent lather with the soap test.

Waters containing the salts of Group 1 are therefore known as temporarily hard waters, and their hardness is spoken of as temporary hardness. Such waters may be softened by adding to them a quantity of milk of lime equivalent to the calcium hydrogen salt present. This salt and the calcium hydroxide are thus converted into, and precipitated as, insoluble normal carbonate, and the water is then free from soluble calcium salts. A similar process takes place with the magnesium hydrogen carbonate present in the water. Unless such temporarily hard waters are softened, they give rise, as you know, to dense boiler incrustations when they are used for raising steam.

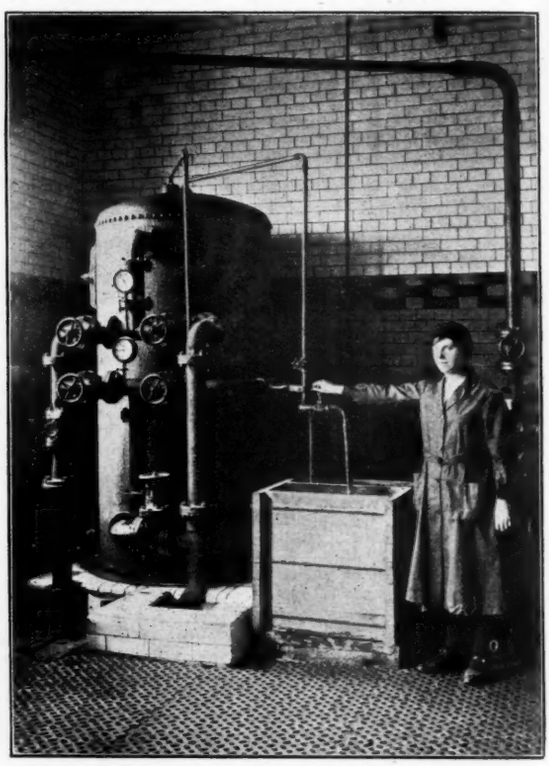
The waters containing salts of Group 2, however, are not softened when they are boiled, as these salts are not converted into insoluble precipitates, and such waters are known as permanently hard waters. When a solution of sodium carbonate is added to a permanently hard water, the sulphates and chlorides of calcium and magnesium are precipitated as insoluble carbonates; and as the soluble sodium salts formed at the same time do not act on soap, the clear water is soft—hence the use of washing soda for laundry work, and for softening permanently hard water for other purposes.

The hardness of natural water is generally due to the presence of salts of both the Groups 1 and 2—that is to say, the hardness is partly temporary and partly permanent, like the trade water we have to deal with. Such waters, however, may be softened by combining the two processes described above, and in other, and in some cases better, ways.

After this preliminary review, we come to the process adopted, which is known as the "Permutit" system. We were advised that, with salt at 50s. a ton, the cost of the "Permutit" process would work out at about 3½d. per 1000 gallons for water of zero hardness, and that the cost of reagents required for lime and soda treatment would be from 2½d. to 2¾d. per 1000 gallons, in addition to which there would be the cleaning of filters and disposal of sludge, while the hardness would not be brought lower than to (say) 4° or 5°. As there appeared to be so little to choose between the two systems on the score of cost, and the "Permutit" plant would occupy less space and require less attention, and could be depended upon to reduce the hardness to zero if desired, it was decided to adopt this process.



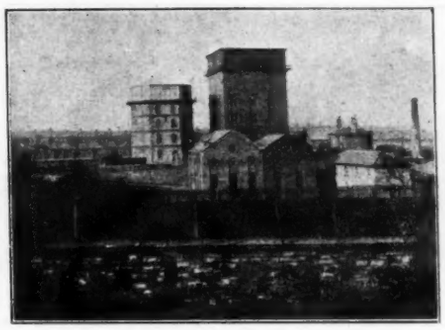
Upper Portion of Waste-Heat Boiler on Blue Water Gas Plant.—No. 2 Works.



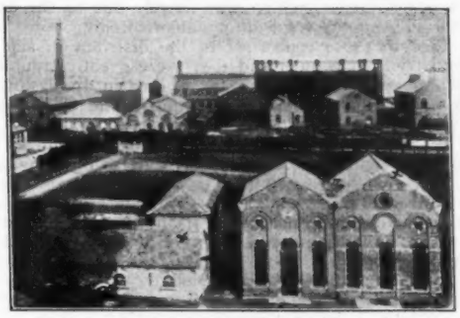
"Permutit" Water Softener in connection with Water Gas Plants.—No. 2 Works.

The plant consists simply of a cylindrical tank containing a bed of artificial sodium zeolite. Connected with this tank is a smaller one, in which is prepared a solution of common salt for the regeneration of the zeolite bed. The control of the plant is simple, and can be carried out by unskilled labour. In fact, this particular plant is attended to entirely by the woman cleaner. The attention required is about half-an-hour for each wash-out.

The hard water passes through the bed of "Permutit," and the temporary and permanent hardness are entirely removed. A chemical action takes place between the calcium and magnesium salts of the water and the "Permutit," which results in the replacement of the sodium in the "Permutit," molecule by calcium and magnesium. When this point is reached, the material becomes exhausted, and requires regeneration. This is effected by passing a solution of sodium chloride slowly through the filter. By this means the calcium and magnesium



View of Pumping Station.



View of No 1 Gas-Works.

are expelled from the "Permutit," their place being taken by the sodium from the salt solution, thus reconstituting the original sodium " Permutit," which is as fresh and active as when first put to work.

The exchange action may be represented chemically by the following simple equations, in which the contraction " Pm " represents the zeolite :

(1) For the softening of temporary hardness (the hardness due to the hydrogen carbonates of calcium and magnesium).

Na_2Pm	+	$Ca(HCO_3)_2$	=	CaPm	+	$2NaHCO_3$
Sodium Zeolite	+	Calcium Hydrogen Carbonate	=	Calcium Zeolite	+	Sodium Hydrogen Carbonate
Na_2Pm	+	$Mg(HCO_3)_2$	=	MgPm	+	$2NaHCO_3$
Sodium Zeolite	+	Magnesium Hydrogen Carbonate	=	Magnesium Zeolite	+	Sodium Hydrogen Carbonate

(2) The softening of permanent hardness (the hardness due to the sulphates, nitrates, and chlorides of calcium and magnesium).

Na_2Pm	+	$CaSO_4$	=	CaPm	+	Na_2SO_4
Sodium Zeolite	+	Calcium Sulphate	=	Calcium Zeolite	+	Sodium Sulphate
Na_2Pm	+	$MgCl_2$	=	MgPm	+	2NaCl
Sodium Zeolite	+	Magnesium Chloride	=	Magnesium Zeolite	+	Sodium Chloride

You will note that the products in each case are soluble sodium sulphate, sodium chloride, sodium bicarbonate, &c., so that there is no sludge.

When the above state is reached, the " Permutit " is exhausted; but, as I have stated before, it is revivified with a salt solution which acts on the exhausted material as follows :

CaPm	+	2NaCl	=	Na_2Pm	+	$CaCl_2$
Calcium Zeolite	+	Sodium Chloride	=	Sodium Zeolite	+	Calcium Chloride
MgPm	+	2NaCl	=	Na_2Pm	+	$MgCl_2$
Magnesium Zeolite	+	Sodium Chloride	=	Sodium Zeolite	+	Magnesium Chloride

In this reaction the calcium and magnesium chlorides formed are both soluble in water, and are washed out after revivification.

The plant takes up very little space, and needs very little attention, and is also wonderfully efficient. But, on the other hand, the amount of wash water (13 p.ct.) is higher than we expected; and when the cost of the salt is added, it cannot be considered a cheap process.

We have now been using the softened water for the last 25 months; and there is an entire absence of scale in the waste-heat boiler. In our main boilers, after transferring from hard to treated water, we find that the scale previously formed is gradually disappearing, and that the boilers will soon be perfectly free from scale. This means that, instead of two days' work for two men every month scaling a boiler, one man can wash out a boiler in a day, and it will not be necessary to let the boilers down oftener than once every six months.

The following working results to date may be of interest :

Average hardness of water before treatment	20·0°
Average hardness of softened water	1·2°
Salt used per 1000 gallons softened water	12·2 lbs.
Cost of salt per 1000 gallons softened water	3 5d.
Percentage of water used for washing	13·1 p.ct.

Coke Recovery by the " Columbus " Process.

In January, 1924, a " Columbus " coke recovery apparatus was installed at the No. 2 gas-works, adjoining the water gas plants, so that the coke from the pan ash from No. 1 works and from the water gas clinker might be recovered and used for the manufacture of water gas. Formerly hand picking was done by old hands who were past heavy work; but the coke recovered was costly, and there is no doubt the bulk of the ashes went straight to the tip unpicked. It is only when one has had experience of an efficient recovery plant that the extraordinary waste of good fuel in the past is realized.

Probably most of those present are fairly familiar with the technical and economic features of the " Columbus " plant. The machine consists of two parts. In the first, the fine ashes and dust are removed by means of a rotary screen; the balance then passing into a separate trough, in which the specific gravity of the separating liquid is so adjusted that the coke floats and is carried through the trough and ejected at the side of the machine, while the clinker sinks and is caught by a lower spiral which ejects it at the opposite side of the machine.

By means of small screens, we divide the products into fine ashes, clinker, coke, and breeze. The last-named is used for boiler fuel, the coke in the water gas generators, the fine ashes are sold at 3s. 6d. per ton for paths and paving, &c., and for the manufacture of cement and ash slabs, while the clinker so far has been supplied free to anyone applying for it.

As a separating liquid we employ a mixture of loamy clay and water of about 1·2 sp. gr. We tried a mixture of spent lime and water; but it was not a success, as the lime set in lumps and sank, instead of forming a uniform mixture.

The working results to date are as follows :

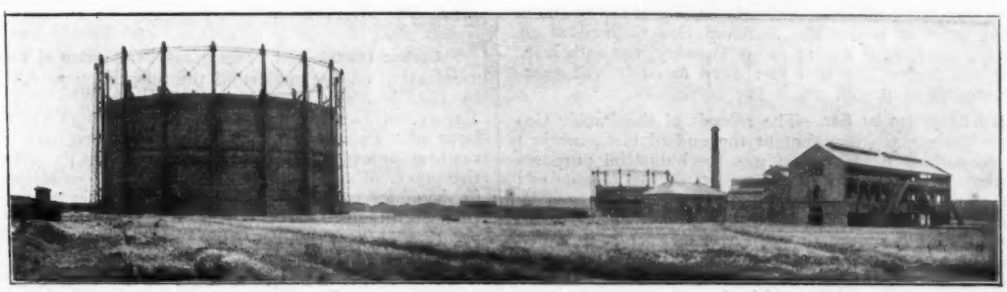
Ashes treated	6157 tons	
Coke recovered	2049 tons	= 33·29 p.ct.
Breeze recovered	455 ,,	= 7·4 ,,
	2504 tons	= 40 69 p.ct.
Clay used		387 tons
Net cost per ton of fuel recovered		1s. 6d.

The separation is very satisfactory and thorough, and the coke is suitable for water gas manufacture, if the proportion used is not excessive. In fact, our experience is that the generator clinker is not quite so hard and difficult to remove, owing to the slight clay deposit on the coke.

In conclusion, I desire to express my sincere thanks to the Directors of the Company, and also to my Chief, Mr. Branson, for permission to hold the meeting at these works, and for so kindly and readily allowing these particulars to be placed before you.

Vote of Thanks.

Mr. Charles F. Barrow (Sunderland) proposed a vote of thanks to the Chairman, and expressed regret that the attend-



WATER GAS PLANTS.—No. 2 WORKS.

ance was not larger, which was largely due to the bad train services. The items regarding water softening were of great importance to those concerned in the distribution side of the gas industry. At Sunderland they were greatly troubled with hard water, and were at present engaged in discussing with a firm a new system of water softening. The Chairman's address would act as a guide in the matter.

Mr. G. W. MARTIN (Houghton-le-Spring) seconded. He remarked that, while the question of water would not affect a great many of them, it would interest those connected with geysers and hot water apparatus. The address would be helpful most of all in the present crisis to those who had a carburetted water gas plant available. He wished he had one at Houghton-le-Spring.

The resolution was heartily carried.

It was decided to leave to the Committee the fixing of the place and date of the next auxiliary meeting.

The CHAIRMAN apologized for the absence of Mr. A. W. Branson, the Manager of the Hartlepool Gas and Water Company, who would have been present to receive the members but for the fact that the date of the meeting had been changed, and Mr. Branson had previously made other arrangements.

The CHAIRMAN invited members to put forward any question they might desire to have answered.

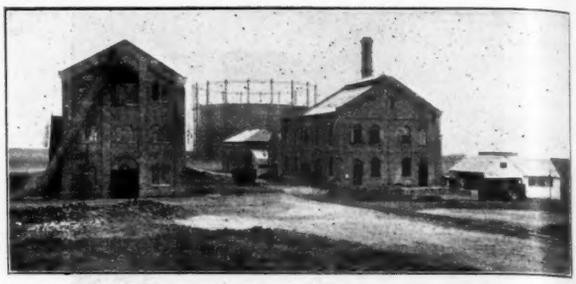
Mr. COPELAND (Newcastle) asked if the water softening applied to the town supply.

The CHAIRMAN: Not at all.

No. 2 Gas-Works, West Hartlepool.

Subsequently the company inspected the pumping station at the water-works, as well as the plant at No. 2 Gas-Works.

These works are situated less than half-a-mile from the other works, and are on the boundary line of the ancient Borough of Hartlepool and the County Borough of West Hartlepool. It is an excellent site for future developments, measuring some 15 acres in extent; and there is another 5-acre plot, the property of the Company, adjoining on the north side. The site abuts on to the L.N.E.R. main line to Newcastle, from which high-



Buildings for Water Gas Plants (blue and carburetted), including Purifying House, Station Meter, Gasholder, and Coke Separating Plant.—No. 2 Works.

level sidings could be laid; and there is already a low-level siding into the works.

At present the only plant on these works is for the manufacture of blue and carburetted water gas and sulphate of ammonia. The water gas plants consist of one Humphreys & Glasgow carburetted water gas set of 750,000 c.ft. capacity per day, and one blue water gas set of 850,000 c.ft. capacity per day, with relief holder, oil storage tank, Lancashire boilers, waste-heat boiler, water softening plant, engines, and station meter. There are three purifying boxes, with Green's type of lids, two of which are 72 ft. by 36 ft., and one 36 ft. square, with oxide elevator, band conveyor, and overhead spreading floor. A three-lift telescopic holder has a storage capacity of 1½ million c.ft.

There is also the "Columbus" coke recovery plant referred to in Mr. Barrett's address. In the sulphate plant mentioned above, neutral salt is produced; the ammoniacal liquor being pumped from No. 1 works to No. 2 works through a 6 in. main.

At the entrance to the works is a fine pressed brick building, consisting of offices and foreman's house.

The Chandler Medal.

The Chandler Medal, which was established in honour of the late Mr. Charles Frederick Chandler, one of the founders of the American Chemical Society, and is awarded annually by Columbia University for achievement in science, has this year been presented to Mr. Samuel Wilson Parr, who is Professor of Chemistry at the University of Illinois. In delivering the Chandler Lecture, Prof. Parr (who enjoys a wide reputation as an expert in the chemistry of coal) dealt with new low-temperature methods which are claimed to have made possible the use of coal mined in the Illinois fields for the production of coke specially adapted to household purposes. These new methods have been discovered as the result of years of research at his University.

National Lime Association.

The Eighth Annual Convention of the National Lime Association was held at French Lick Springs, Indiana, from June 8 to 11. At this meeting Mr. L. B. Burt, Manager of the Industrial Department of the Association, read a paper entitled "Opportunities in the Industrial Field." In this he said that the use of lime has enjoyed a substantial increase in water softening and purification practices, and that the future prospects are excellent. Municipal water softening has trebled in the past three years, and there is every reason to believe that the rate of increase will be higher as time passes. Mr. C. R. Stokes, Manager of the Highway Department of the Association, contributed a paper on "Lime in Concrete Highway Construction," and another communication was from Mr. G. J. Fink, Director of the Association's Laboratories, who spoke on "The Practical Aspects of Research."

Southern Gas-Works Coal Supplies.—Mr. H. C. Head asks us to announce that there will be a general meeting of the Southern District Executive Board of the National Gas Council at 28, Grosvenor Gardens, S.W., at 11.30 on Tuesday, the 29th inst., to consider the present position in regard to coal. All members are requested to attend.

Reducing Lead Ore by Gas.—The records of the Pacific Gas and Electric Company show that at the end of last year just over 4000 consumers made use of gas for industrial purposes in California, or slightly more than 1 p.ct. of the 360,000 odd consumers of all kinds who were being supplied with gas by the Company. One industrial use thus made of gas is to reduce lead ore. Gas is passed through a heated retort in which there has been placed a quantity of this ore. According to Mr. C. W. Geiger, writing in the "American Gas Journal," the carbon in the gas combines with the oxygen in the lead ore, leaving pure lead.

The Therm as a Unit of Boiler Capacity.

Writing in the June issue of "Combustion," Mr. H. W. Brooks suggests that the term "boiler horse-power" as a measure of boiler capacity should be abandoned. Its continuing recurrence, he says, can only be attributed to the lack of an acceptable substitute to date. Many have turned to "square feet of heating surface." To be consistent, such persons should rate motor sizes in "square feet of exposed coil," and turbines in "square inches of blade area." As a measure of capacity, such terms tell just enough of the story to be confusing. None of these quantities represents more than one of the contributory causes which go to make up a desired result. Others have proposed pounds of steam per hour as a preferable term. There are two principal objections to this. Modern boiler sizes necessitate unduly lengthy strings of zeros, which make for error, and the term leads to confusion unless the unwieldy "from and at 212° Fahr." differentiates it from steam "at delivered pressure and temperature." The "therm-hour" (T.H.), suggests Mr. Brooks, would be roughly a little less than three boiler horse-power hours, or about what 10 sq. ft. of surface are called on to average at the modern rating. "Therm-hour" is easy to say and to abbreviate; it conveys a distinct idea of heat quantity; it is a unit which in boiler practice can be expressed in three or four figures; its extensive use in the gas industry has failed to reveal faults. The author concludes by asking if there is a better term, or whether there are insurmountable practical difficulties confronting the acceptance of the proposed new term.

Coal and the Gas Industry.—This is the title of an interesting article contributed by Mr. A. Gordon King to the June 9 issue of the "Coal and Coal Trade Journal." He expresses the belief that the use of gas for domestic, commercial, and industrial purposes is still in its infancy.

Carbon Dioxide and Spontaneous Combustion of Coal.—A communication on the subject of the adsorption of carbon dioxide by coal is made by Messrs. Eric Sinkinson and Homer G. Turner, of Lehigh University, Bethlehem (Pa.), to the June issue of "Industrial and Engineering Chemistry." Their investigation leads them to the conclusion that the greater adsorptive power of anthracite than of bituminous coals appears to lie in the character of the carbon present rather than in its quantity. With coal, carbon dioxide will produce elevations of temperature above those obtained with oxygen under similar conditions; and it is suggested therefore that carbon dioxide plays an important part in spontaneous combustion, by producing an immediate rise in temperature, through the adsorptive energy between the coal and the gas.

REGISTER OF PATENTS.

Quenching Coke.—No. 246,497.

ALBACH, F., of Berlin-Tegel.

No. 1913; Jan. 22, 1926. Convention date, Jan. 22, 1925.

The patentee points out that it has been proposed to quench coke taken from gas generators on the flat, perforated floor of a truck; water being sprayed out of the floor. This method renders it unnecessary to turn the coke over, so that it is not broken up so much, and also saves water, because only so much need be used as will suffice for quenching; but it has been found that the water holes in the floor are liable to become choked, so that high water pressure must be used, and the holes must be very numerous.

According to the present invention, the floor of the truck is formed of slats disposed in the manner of a Venetian blind. If these slats are set at an angle, the under surface of the coke layer is largely exposed, because the lumps rest on the edges of the slats, and the water can penetrate more easily. Obstructions may be removed by rocking the slats, and the water pressure need not be high. The slats may be hollow and be fitted with sprayer nozzles, so that the water cools them well. The nozzles at the lower parts of the slats are kept clear of the coke.

A further feature of the invention is the provision of a "shovel" for feeding the truck; the shovel being designed to spread the coke well, but to minimize breakage.

Treatment of Waste Liquors.—No. 250,824.

DENIS, J., of Brussels.

No. 32,350; Sept. 18, 1925.

This invention is concerned with the treatment of waste liquors containing cyanogen compounds, and is based upon known methods of precipitation of hydrocyanic acid by an alkali and ferrous sulphate, in an acid medium, and the elimination of the phenols and hydrocarbons by a current of air or other gas. The object of the invention is so to purify the waste liquor that it can be discharged into a river without danger. The cyanogen compounds are recovered in a relatively pure and concentrated form, while the phenols and hydrocarbons are economically recovered in the form of valuable fuel by means of a simple device adapted to work continuously. The purification is divided into two parts. In the first phase the liquor is mixed with an alkali hydrate or an alkaline earth hydrate and ferrous sulphate, and is made acid by carbon dioxide, to produce precipitation of the iron ferrocyanide, which afterwards is discharged in the form of a blue sludge into a filtration plant. In the second phase the carbonated liquor separated from the sludge is treated with barium hydrate or some other coagulant precipitating with carbonic acid, to entrain the last traces of ferrocyanide of iron which this carbonated liquor may contain. The liquors thus treated are decanted to separate the precipitate formed in the second phase. When the liquor contains phenols, these are separated by difference of density before or after addition of the two reagents in the first phase, and are conveyed into a closed reaction chamber into which a current of air is passed, while the liquor carried over when decanting the phenols is returned to the liquor to be treated. The two phases of the process can be successively executed in the same apparatus. One phase can also be carried out in one apparatus, and the second in another. The different units may be increased in number and made sufficient to enable continuous working of the process.

Tubular Gas Burners.—No. 251,907.

KEITH & BLACKMAN CO., LTD., of Farringdon Avenue, E.C. 4.

No. 1733; Jan. 21, 1926.

[Communicated by BAKER PERKINS CO., INC., of Saginaw, Michigan.]

This invention relates particularly to long slotted tubular burners used, for example, in baking-ovens. The object is to provide a simple and inexpensive construction devised to ensure continuous and substantially uniform heating throughout the length of the burner, while minimizing liability to back-firing or explosion.

With this object in view, the invention provides for the adaptation to such burners of spacing members of known form comprising a bar or strip wrapped helically by wire to afford passages which permit the flow of fuel and air from the burner.

The claims show that the burner comprises a long slotted tubular member having provision for supplying gas or vapour and air to the interior thereof, check bars mounted in the slot, another bar substantially midway intermediate said check bars, and a spacing bar interposed between the said intermediate bar and each of said check bars, each of said spacing bars having wire wrapped helically thereabout to provide a plurality of individual passages between itself and the adjacent check bar, and between itself and the intermediate bar.

When a double flame is desired, a second tubular member is mounted in, and communicates with, the slotted member.

Purification.—No. 251,755.

MILES, T. V., ALLOTT, G. W., and NEWTON CHAMBERS & CO., LTD., all of Thorncliffe Ironworks, near Sheffield.

No. 10,046; April 17, 1925.

This invention has for its objects to provide an improved method of and means for maintaining a definite regular temperature in coal gas dry purification plant, where oxide is employed, and to obtain the following advantages: To dispense with the use of steam or steam coils in the oxide boxes; to avoid the generation of excessive moisture and back pressure; to take advantage of the economy that can be achieved by building elevated purification plants unprotected without detracting from their efficient working; to dispense with the necessity for the comparatively elaborate systems of valves and connections for achieving a backward rotation of the gas in order to reduce back pressure; to minimize the conditions favourable to the secondary reaction forming sulphuretted hydrogen; to assist condensation in the gradual manner generally approved of, and to effect a considerable economy in the quantity of water used. Generally to enable the required temperature for maintaining efficient working to be obtained and maintained.

To these ends the whole or a portion of the unpurified gas from the hydraulic main is passed through a heat exchanger for the purpose of raising the already wet purified gas to the required temperature preparatory to its dry purification in the oxide boxes.

The heat exchanger has its hot element connected to the pipe system leading from the hydraulic main to the condensers and scrubbers, and its cool element connected to the pipe system leading from the scrubber to the oxide plant; and valves and by-pass pipes are provided for controlling the passage of the gas through the respective elements of the heat exchanger. The latter consists of a body built up and flanged removable plates, baffle plates arranged to form a sinuous chamber and having their edges clamped between the flanges of the removable plates, groups of sinuous tubes having their inlet and outlet ends received in manifold pipes, inlet and outlet pipes for the chamber and for the manifold pipes, and by-pass pipes for cutting-out the heat exchanger or regulating the flow therethrough.

Coin Receptacles.—No. 252,289.

BINGHAM, J. H., of Harrow, and GLOVER, G., & Co., LTD., of Chelsea, S.W. 3.

No. 11,957; May 8, 1925.

This invention for a coin receptacle or money box for coin-freed mechanism seeks to provide a construction allowing for the use of strong parts adapted to resist force exerted for the purpose of breaking open the receptacle.

The box comprises a cylindrical wall rotatably mounted between flat end-plates, the cylinder having an aperture therein which can be brought by rotation to the upper part or to the lower part of the receptacle. The cylinder is mounted at opposite ends on or in circular rims, shoulders, ledges, or grooves on or in the flat end-plates, or these plates are seated in recesses within the cylinder, so that at each joint there are two or more abutting surfaces.

The end-plates are held spaced apart coaxially by posts extending from each plate, and the means of joining these posts is accessible through the coin opening.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for June 16.]

Nos. 14,213-14,867.

BIANCHI, A. E.—"Apparatus for cracking, &c., carbonaceous materials." No. 14,468.

BRITISH ARCA REGULATORS, LTD.—"Automatic combustion control." No. 14,406.

CHEW, S. N.—"Gas and air washing apparatus." No. 14,684.

COOKE, A. G.—"Stuffing-boxes for gas meters, &c." No. 14,593.

COPPEE ET CIE., E.—"Coal washing apparatus." No. 14,472.

DEMPSTER & SONS, LTD., R.—"Manufacture of coal gas." No. 14,229.

FABRY, R. F. F.—"Coke manufacture." No. 14,418.

GUARDABASSI, G.—See Bianchi, A. E. No. 14,468.

HUDSON, G. C.—"Geysers." No. 14,377.

HUDSON, J. J. C.—See Hudson, G. C. No. 14,377.

LOW-TEMPERATURE CARBONISATION, LTD.—"Doors for closing retorts, &c." No. 14,298.

LOW-TEMPERATURE CARBONISATION, LTD.—"Distillation of coal, &c." Nos. 14,299, 14,300, 14,301.

PARKER, C. H.—See Low-Temperature Carbonisation, Ltd. Nos. 14,299, 14,300, 14,301.

PARKER, J. F.—See Low-Temperature Carbonisation, Ltd. No. 14,298.

PHILLIPS, B. C.—See Cooke, A. G. No. 14,593.

TOOGOOD, H. J.—See Dempster & Sons, Ltd., R. No. 14,229.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Controllers for Hyde Park Lamps.

SIR,—In your issue dated April 28, we notice that you report that the public gas-lamps in Hyde Park are about to be fitted with automatic controllers, believed to be of our manufacture. We should be glad, however, if you would make a note in your next issue to the effect that we do not know from what source this report emanated, but would like to state that we recently received an order from the Gas Light and Coke Company for a number of controllers for Hyde Park lighting.

THE HORSTMANN GEAR COMPANY, LTD.
A. HORSTMANN, Director.

Newbridge Works, Bath,
June 17, 1926.

PARLIAMENTARY INTELLIGENCE.

GAS LIGHT AND COKE COMPANY'S BILL.

The Minimum Dividend.

HOUSE OF COMMONS COMMITTEE.—Wednesday, June 16.

(*Before Sir* Park Goff (*Chairman*), *Sir* Henry Jackson, *and Mr.* Beckett.)

The Bill deals with the finances of the Gas Light and Coke Company, and provides for a minimum dividend.

Counsel for the Bill were Mr. H. P. Macmillan, K.C., Mr. Tyldesley Jones, K.C., and Mr. H. W. Beveridge. The opponents were the West Ham Corporation, represented by Mr. Arthur Moon; the London County Council, represented by the Hon. Evan Charteris, K.C., and Mr. Rowand Harker, K.C., who also appeared for the Middlesex County Council.

Mr. Macmillan, opening the case for the Bill, said that under clauses 4 to 7 it was proposed to extend the Company's borrowing powers; clauses 8, 9, and 10 dealt with small matters to which there was no opposition; and clause 11 proposed to set up a minimum dividend for the Company. The last-named was the most important clause for the Company, and was the one to which there would be the most opposition. Under clause 4, the Company asked to be allowed to borrow up to one-half of the nominal amount of the issued capital; and as the issued capital was £25,545,980, if the clause were passed it would mean that the borrowing powers would amount to £12,772,990. As the present loan capital was £6,238,735, the Company would have increased borrowing powers to the extent of £6,534,255; and if from this were deducted the existing unexercised borrowing powers, the net increased borrowing powers would be £4,230,214. As showing the manner in which the Company had kept down capital expenditure, Counsel stated that in 1900 the capital employed represented 12s. 9d. per 1000 c.ft., while in 1925, under the policy of administration that had been pursued during the succeeding quarter-of-a-century, the amount was 8s. 7d. The Company had during that period devoted themselves to a reconstruction of the plant, and had overhauled the machinery and retorts, and in this way had been able to meet the increasing demands without additional capital expenditure; but the limit to this had been reached, and if the demands which the Company now saw ahead were to be met, it would be necessary to incur large capital expenditure. The position at the present moment was a bank overdraft of £1,500,000, and resort had been had to the various internal domestic funds of one kind and another to the extent of nearly £2,000,000, and to the undistributed profits at the credit of the revenue account to the extent of about £250,000. This amounted in all to some £3,750,000, which covered the overspent capital and the working capital; and it explained how the Company had been carrying on. There was nothing irregular about it; but it was not a position the Company liked to be in. It was a remarkable fact, with a Company of such magnitude, that no funds had been raised since 1901; but it was the best possible evidence that the Company had been managed in an economical manner. There were a large number of precedents for giving 50 p.ct. borrowing powers in relation to nominal issued capital; and, in fact, it was agreed by the opponents to be modern practice.

The next clause to which he wished to refer was clause 11, which dealt with what might be called the central matter in the Bill—viz., the fixing of a minimum dividend—it being proposed that there should be a minimum dividend of 5 p.ct. on the ordinary stock. After a lengthy explanation of the principle of the sliding-scale, Counsel said that the proposal now was to stereotype a dividend of 5 p.ct. as the minimum upon the ordinary shares, notwithstanding that the operation of the sliding-scale, if it were allowed free play, would necessitate the payment of a dividend less than 5 p.ct. It was not proposed that this should be in any sense a guaranteed minimum, but only if the funds permitted. While this was an innovation so far as the Company were concerned, it was by no means an innovation in gas legislation. He then gave a short account of the history of gas charges, and, indeed, of the whole industry, from the commencement down to the passing of the Gas Regulation Act of 1920, and emphasized the importance to the consumer—inasmuch as cheaper capital meant cheaper gas—of stability to the gas shareholder. The position would be that the minimum would not be paid unless the Company were in a position to pay £5 4s. p.ct., as 4s. had to go to the redemption fund as a statutory obligation.

Counsel then went on to explain the varying fortunes of the Company during the war and since, and how they had fared since obtaining a Therm Order in 1921; the standard price being then fixed at 1s. 3·2d. per therm, which was subsequently reduced to 11d. in 1924, on the application of the London County Council. In 1925 the price of gas was 8·6d. per therm; but during that year there was a serious slump in residuals, and for the second half the price of gas was raised to 9·4d. per therm—this having the effect of reducing the permissible dividend from £5 6s. 8d. to £4 17s. 4d., through circumstances which were in no way attributable to any default of the Company. The £4 17s. 4d. was in addition to the amount required for the redemption fund, the total being £5 1s. 4d. This result was unfair to shareholders. In November, 1925, the Company applied to the Board of Trade for an upward revision of the standard price; and the case was so clear that the Board of Trade—the London County Council agreeing—increased it from 11d. to 11·4d. per therm. The result was that the Company could now pay a dividend of just over 5 p.ct. on the ordinary capital. The trouble was, however, that the damage had been done, so to speak, inasmuch as the remedy applied by the Board of Trade came too late to prevent a lower dividend rate being paid than 5 p.ct. for one half-year; and although it was the intention of the Act of 1920 to correct the effect of alterations of price due to circumstances beyond the control of the Company, in actual practice it had been found that the Act was a postponed remedy, and not a preventive. In this respect it was submitted that the Act of 1920 had proved an imperfect remedy for circumstances such as had been experienced. There would always be a lag, because, until a loss had been sustained, it was impossible to prove a case to the Board of Trade for an increase in the standard price.

The criticism of the proposal for a minimum dividend of 5 p.ct. seemed to be that it would deprive the sliding-scale of one of its most valuable elements—viz., the incentive to efficient working. The fact was that the Company had been paying a little over 5 p.ct., and 5½ p.ct. seemed to be a reasonable return; so that there would still be the incentive to more efficient working in order to be able to pay a higher dividend than 5 p.ct. Not only so, but the Company carried on operations in the presence of keen competition and rivalry. Therefore it was impossible to imagine that the Board would, while they could pay 5 p.ct., sit down and make no attempt to improve the efficiency of the Company, and so reduce the price to the consumer. Moreover, under the Act of 1920, it was open to any local authority or twenty consumers to apply for a reduction of the standard price, and so affect the operation of the sliding-scale at any time. Thus the whole situation was completely altered from the time when the sliding-scale was first devised. It was in these circumstances that the Company had been advised, and were satisfied, that it was highly desirable, in the interests of the Company, that their minimum dividend should be fixed at 5 p.ct. In support of this, he would refer to certain precedents, the most interesting of which was that of the South Metropolitan Gas Company, who had got themselves out of the 1920 Act altogether. In 1920, just at the time when the general legislation was coming forward, Parliament gave the South Metropolitan Gas Company a code of their own, and a minimum dividend of 5 p.ct. on the then existing capital and 6 p.ct. on new capital. Parliament also said the Company should come to Parliament in five years, to show what they were doing; and when that was done in 1925, the Company were given permission to continue on the same basis for a further ten years. In this case the Company worked on a basic price, which was to all intents and purposes a standard price. The Gas Light and Coke Company preferred the method now proposed, because if there was a defect in the South Metropolitan scheme it was that it was impossible to tell with certainty until the end of the year what the dividend was going to be. In the case of the Gas Light and Coke Company the position was simpler and clearer, because, in conjunction with the 5 p.ct. minimum, the price of gas at once showed the amount which would be distributable for the half-year. In addition to the South Metropolitan Company, other companies had been granted minimum dividends—viz., Cardiff in 1921, Swansea in 1921, Chester in 1922, Sheffield in 1922, and Windsor in 1922. Moreover, the same principle was embodied in the London Electricity Supply Acts of last session; the principle of the minimum dividend and the sliding-scale having been applied to the fourteen electricity supply companies who were the direct competitors of the gas companies.

Mr. *D. Milne Watson* (Governor and Managing Director of the Company) was then called, and dealt with the matters outlined by Counsel. As regards the proposal for borrowing powers to the extent of one-half the nominal capital, he said that the important aspect was the charge for capital in the operations of the Company; and as showing the efficiency of the management, he pointed to the fact that between 1900 and 1925 this charge had been reduced by 26 p.ct. A point had been reached, however, when additional plant would have to be installed from time to time to meet the demands. For instance, as a result of the acquisition of the Brentford undertaking, there would have to be large additions to the mains. Again, capital would be required to meet the competition of electricity, which had necessitated the opening of numerous showrooms. The position to-day was that they were overdrawn on capital account to the extent of £855,000 in respect of the old Gas Light and Coke Company and £550,300 in respect of the Brentford Company. The amounts which would be required to be spent in the future were £3,250,000 for extension of gas-works, £1,500,000 for mains, £1,500,000 for meters and stoves, and £750,000 for showrooms—making a grand total of £7,000,000.

Thursday, June 17.

Mr. *Milne Watson* (continuing his evidence) said that, in order to arrive at the estimated capital expenditure, certain estimates of the future demand had been made. During the past seven years there had been an increase in the demand of 37·5 p.ct., an average of 5·36 p.ct.; but to be on the conservative side he had taken 3 p.ct. per annum as the probable increase over the next few years. This referred to the Gas Light and Coke Company's area, apart from the Brentford area. Regarding the question of the minimum dividend, he said he had no doubt that, but for the war, the Company would now be paying 5½ p.ct. on the ordinary stock. This statement was based upon careful calculation, and was not a mere generalization. The small drop in dividend in 1925 had had a serious effect upon what, for want of better words, he would call the stability or attractiveness of the Company's stock. The stock of the Company had a very free market, as distinct from the stocks of some of the pro-

vincial companies, which were held tightly locally; and if a person inquired about the Gas Light and Coke Company's stock, and was told by a broker that it was a good investment but was subject to uncertainty as to how the Gas Regulation Act affected it, this would have an effect upon the market. Evidence would be given showing how, since the war, the Company's stock had not attracted the same class of small investor. It had lost its appeal to the class of investor to whom it used strongly to appeal. The reason was that such investors did not feel the same security that they used to. The Company's stock had been depressed for three reasons in recent years—first, there was the war; secondly, there was the Gas Regulation Act, which, although it had been an advantage, had the disadvantage that the dividend might go down, and it took some time to rectify it; and, thirdly, there was the Government electricity scheme. Without wishing to criticize what the Government thought fit to do about electricity, there was no doubt the Bill had done an enormous amount of harm to the Company's stock, because people were very nervous about what might happen. This was seen in the fact that, before the Government came out with their electricity scheme, the stock could be bought to yield 5½ p.ct., whereas to-day it could be bought to yield well over 6 p.ct.

A table was handed to the Committee showing how the 5 p.ct. minimum dividend would operate; and it was seen that at 9·8d. per therm charge to the consumer the 5 p.ct. minimum would become operative, because the actual dividend under the sliding-scale at that charge would be £4 17s. 4d., excluding the redemption fund payment.

The Hon. EVAN CHARTERIS (cross-examining for the London County Council and the Middlesex County Council) suggested to witness that the position when the South Metropolitan Company got their Act in 1920 was that the Government legislation had not been introduced, and it was stated to the Committee that nobody knew what it would be. Therefore the South Metropolitan case was put forward as a concrete case of hardship, and was dealt with as such.

Witness agreed, but added, in answer to further questions, that when the London County Council in 1925 said to Parliament that the South Metropolitan Company ought now to come within the Gas Regulation Act, Parliament refused.

The Hon. EVAN CHARTERIS then dealt with the point that the Company's stock would have greater stability under a minimum dividend, and suggested that this was not very important, when, as in the case of the Gas Light and Coke Company, most of the capital was raised by borrowing. He also suggested that the safeguard to the consumer now provided under the sliding-scale would be removed by the Bill.

Witness would not accept that point of view. The position was that the Gas Light and Coke Company claimed to be allowed the advantages of modern legislation as seen in the South Metropolitan Act and the other Acts which had been referred to by Counsel. The sliding-scale continued to operate in both ways above 5 p.ct.; and the clause gave the Company the minimum of 5 p.ct. for the reasons explained. The procedure under the Gas Regulation Act involved constant applications for revisions, according to circumstances; and that did not lead to stability of the stock in the eyes of investors.

Mr. MOON (for the West Ham Corporation) adopted the cross-examination of the Hon. Evan Charteris, but put a few other questions.

Witness, in reply to these, said the scheme of the Bill was to enable the Company to issue stock at a better price, and so benefit the consumer as well as the shareholder, inasmuch as the cheaper capital would result in cheaper gas.

Mr. MOON said he wished to bring out another point—viz., that the pre-war dividends paid by the South Metropolitan Company were considerably higher than the minima for the new and old capital fixed in that Company's Act of 1920. He did not object to 5 p.ct., as long as it was obtained by reducing the price. He put it to witness that the South Metropolitan case was the only contested case, and that the other precedents referred to were by agreement.

Witness reminded Counsel that the Unopposed Bills Committee took a very keen interest in the contents of Bills, even if they were unopposed. Whether the Bill passed or not, the Company hoped to maintain a dividend of over 5 p.ct., and to increase it by further efficiency. Therefore, the benefit he looked to from the Bill was to be able to say that the stock was a 5 p.ct. stock.

Sir HENRY JACKSON asked witness in what way he was apprehensive that the present electricity proposals of the Government might result in unfair competition with the gas industry.

Witness said the industry was very apprehensive when the Government proposals were first brought forward; but to a certain extent what had happened in the Committee Room in connection with the Bill had relieved them, because there was now a Committee of Appeal or Board of Appeal under the Bill. This had relieved the immediate anxiety as to unfair competition; but the effect of electricity having been taken up by the Government had been a most serious matter for gas stocks generally. It had created the impression up and down the country—a very great many people believed everything the Government said was correct—that electricity was the thing of the future; and this had weakened the confidence of the public in the gas industry. Indeed, it was true to say the matter had gone farther than that. There were some extremely foolish people who were not putting gas into their houses at the present time, because they believed that the electrical age was about to dawn, and that they were going to have cheap electricity for everything. This was the cloud the gas industry was under. The impression was on the investor that electricity in the future was going to do a great deal of harm to gas stocks; and for this reason gas stocks were out of favour. He wanted to restore their position.

Sir HENRY JACKSON said he believed the Company's Bill would be of great benefit to their co-partnership scheme.

Witness, answering the CHAIRMAN, said the £750,000 on showrooms had been calculated for a period of eight years, and was upon the basis of past experience. The programme with regard to showrooms had only just begun.

Mr. Thomas Hardie (Chief Engineer to the Company) explained that the recent policy of the Company had been to reconstruct existing plant, and by this means to secure the additional capacity required to meet the demand. In some cases it had been possible to get an increase of output with a reduction of plant. The point had been reached, however, when new plant was required; and heavy expenditure must be contemplated in the near future.

Mr. *Stephen Lacey* (Distributing Engineer to the Company and Deputy Controller of the Gas Sales Department) said that at the end of 1925, before the amalgamation with the Brentford Company, there were 2850 miles of mains in the Company's area, from 48 in. diameter downwards. The Brentford amalgamation added a further 850 miles, making 3700 miles. During the next eight years he estimated an expenditure of £1,000,000 would be necessary on mains of 12 in. diameter and under and on service pipes, and £500,000 on trunk mains—a total of £1,500,000—while a similar sum would be required for meters and stoves.

Sir *William Plender* was then called, and said he gave evidence for the South Metropolitan Gas Company in 1920, when the Bill giving a minimum dividend was before Parliament, and also again in 1925, when the Company came to Parliament in accordance with the arrangement made in 1920. He was in entire accord with the views of the South Metropolitan Company as to the expediency and necessity, on behalf of the Company and the public, of the régime set up by the Bill in 1920. He also advised the London electricity supply companies who were given a sliding-scale and a minimum dividend last year. He regarded the Electric Supply Acts of last year as analogous to, if not a complete precedent for, the present proposal of the Gas Light and Coke Company.

Friday, June 18.

Sir *William Plender* (continuing his evidence) dealt with the proposal that the Company should have a minimum dividend of 5 p.ct. on the ordinary stock. This, he said, was fair, because the figures of dividends paid pre-war showed that in all probability, had there been no war, the Company would have quickly reached 5 p.ct. after payment to the redemption fund. In 1922 the Company had actually paid £5 4s., in 1923 the dividend was £5 5s. 4d., in 1924 it was £5 6s. 8d., and for the first half of 1925 the amount was also £5 6s. 8d., dropping to £4 17s. 4d. in the second half of that year on account of the prices for residuals having fallen. But the average for those years was £5 2s. p.ct. Seeing, therefore, that with the present price the Company could pay this dividend, it was justifiable to ask for a minimum of 5 p.ct. After all, capital was entitled to a fair return for its use, just as a workman was entitled to a fair wage; and he placed the fair return on the capital of a company like this at 5 p.ct. In the case of the London electricity supply companies an agreement had been come to allowing 7 p.ct. after 1931 as the minimum dividend; but the point to be made clear was that 5 p.ct. could not be paid by the Gas Light and Coke Company unless they had earned it. The minimum dividend was neither guaranteed nor cumulative. The advantages to the Company from the public point of view of a minimum dividend bringing with it stable conditions, had been stated by Mr. Milne Watson; and he agreed with what was then said. Dealing with the suggestion by the opposition that the bottom would be knocked-out of the sliding-scale, witness said he should have thought that leaving the Company with a minimum of 5 p.ct., coupled with the competition from electricity, was sufficient inducement to the management so to improve the efficiency that higher dividends could be paid. He felt it would be a shock if the consumers thought the 5 p.ct. was stereotyped. They would naturally look for a higher dividend; and unless the Directors could, by efficient management, improve the dividend, the shareholders would have something to say about the matter. He shared the views expressed by Mr. Milne Watson as to the delay involved in applications for revision of prices under the Gas Regulation Act.

Cross-examined by the Hon. EVAN CHARTERIS, Sir William said he was not aware whether the precedents that had been quoted were opposed or unopposed. All he knew was that minimum dividends had been sanctioned.

COUNSEL pointed out, also, that in the Rhymney and Aber case the Committee of the House of Lords who dealt with it as an opposed measure refused to grant the minimum dividend, although it was added that the decision was given in the particular circumstances, and not as representing any views on the principle.

Witness agreed that under the proposed Bill the present 4 p.ct. standard would be made a 5 p.ct. minimum; but he could not agree that the minimum dividend knocked-off the sliding-scale altogether. It was pointed out to witness that the consumer would have to find the extra 1 p.ct., and he agreed, adding, however, that at the present time the Company were able to pay this 5 p.ct. without calling on the consumer for it, and there was every indication that the price would be still further reduced and the dividends increased. All that was asked was that the minimum dividend should be one of 5 p.ct., if the Company were able to pay it.

COUNSEL then put it that the financial proposals of the Bill would carry the Company on for twelve years at the rate of £500,000 a year.

Witness reminded him that there were certain bankers' loans to be paid off in the meantime, so that the period before the Company came to Parliament again would not be so long as twelve years. There was due to the bankers at the end of 1925 the sum of £1,511,000; and no prudent Board would ignore the possibility of its being called in. On the other hand, there were funds invested in the business amounting to £1,978,000, and in his opinion a large part of those funds ought to be in liquid form. The two items he had mentioned amounted to about £3,500,000; and when this amount was taken away from the £6,500,000 new capital powers under the Bill, there would remain £3,000,000 which, at the rate of £500,000 per annum, would carry the Company on for six years.

COUNSEL: That is assuming the Company act in a different way from what they have been doing?

Witness said he was only pointing out the facts.

Counsel then dealt at some length with the influence of a minimum dividend on the ordinary stock upon the terms on which loan capital could be raised.

Witness said the existence of such a minimum dividend would certainly be one of the factors to be taken into consideration in fixing the terms for loan capital; and variations in market price would be bound to affect any bid made for loan capital. A stock which had a stable market price would certainly appeal to him with more favour than one which had not.

Asked as to which particular case he had in mind when he said that procedure under the Gas Regulation Act involved delays, witness said he had the Gas Light and Coke Company in mind. He had never attended an inquiry at the Board of Trade under the Gas Regulation Act; but the Gas Light and Coke Company lodged their last application in November, 1925, and did not hear the decision until June, 1926.

Mr. Arthur Moon then took up the cross-examination, and dealt with the position from the consumers' point of view. He suggested that it was as unfair to endeavour to increase the standard dividend from 4 to 5 p.ct.—which he maintained was the effect of the Bill—as it would be to try to reduce it after an investor had invested his money upon the one basis or the other.

Witness replied that he could not see what this had to do with the matter; and in any case the investor in the Gas Light and Coke Company did not invest his money to get 4 p.ct. only. He repeated his belief that a minimum dividend of 5 p.ct. would assist the Company to borrow on more favourable terms.

Mr. Moon pointed out that both the South Metropolitan Gas Company and the Gas Light and Coke Company had a 3 p.ct. debenture, and said that, according to the Stock Exchange List, these two debentures in 1925 stood at exactly the same figures—viz., £62 as the highest and £58 as the lowest—yet the South Metropolitan Company were working under a minimum dividend for the ordinary stock and the Gas Light and Coke Company were not. This, he said, did not bear out the view expressed by Sir William that a minimum assisted the borrowed capital.

Mr. *Lawrence Currie* (one of the Managing Partners in the banking firm of Glyn, Mills, & Co., and President of the Bankers' Association) said his firm had acted as bankers to the Gas Light and Coke Company for nearly a hundred years. Before the war, the stock of the Company stood very favourably in the eyes of investors, for the reason that it gave a stable return, and an investment in that stock was regarded as one that had promising prospects. He often had to advise intending investors; and the Gas Light and Coke Company's stock held a high place among the investments he submitted. The debenture stock fell within the category of gilt-edged stocks, and the ordinary stock almost did. Then there was the drop during the war; and the Gas Regulation Act had since helped to re-establish the position. The drop in dividend last year, however, had a disturbing effect, and people no longer had the confidence in the stock they used to have. It was not so much the fact that the dividend was 2s. 8d. below 5 p.ct., as the feeling of insecurity and uncertainty with regard to the stock generally. This feeling of insecurity, arising out of the drop of dividend last year, would have a prejudicial effect upon an issue of stock now, unless the public thought steps were being taken to remedy it, such as were foreshadowed in the present Bill. A minimum dividend of 5 p.ct. would certainly have a good effect in removing the feeling of insecurity; and it was highly desirable that a step of this kind should be taken, in the interests both of the consumers and the shareholders. A minimum of 5 p.ct. was by no means excessive.

Mr. *Charles Henry Whittington* (Senior Partner in the firm of C. J. Whittington & Co., stockbrokers), who said his firm was one of the largest dealers in gas stocks, also spoke as to the position held by the Gas Light and Coke Company's stock before, during, and after the war, and agreed with the previous witness that the drop in dividend last year made investors uneasy. It was regarded as unsatisfactory that there should be fluctuations of this kind; and nothing could be better in connection with raising new stock or borrowing than to be able to say that the dividend on the ordinary stock was not likely to fall below a certain figure. It was a very wise step to come to Parliament and ask for a 5 p.ct. minimum.

In cross-examination by the Hon. Evan Charteris, witness said he believed there were not so many dealings in South Metropolitan Gas Company's stock since the basic price and minimum dividend were fixed in 1920. In other words, the stock did not come into the market; and this would account for the fact that the 3 p.ct. debentures of the South Metropolitan Company and Gas Light and Coke Company stood at about the same figure, notwithstanding the fact that one Company had a minimum dividend and the other had not. The marketability of a stock determined the price to a very large extent; and it was not surprising to those on the Stock Exchange that the two stocks should be at about the same figure, although it might be surprising to some people. For the same reason, it was not surprising that the South Metropolitan Company's stock stood at about the same figure to-day that it did before the Company's Act of 1920.

Mr. Moon suggested that, if the minimum dividend were made applicable to the new capital only, the Company would achieve the object of giving stability to the stocks.

Witness replied that this would not necessarily be the case, because the existing shareholders would be looked to largely to provide the new capital. He agreed that one effect of the present Bill had been to raise the price of the Gas Light and Coke Company's stock; but the consumer was benefited, because if money could be borrowed on better terms the price of gas was influenced to that extent.

This concluded the case for the Company.

The Hon. Evan Charteris then addressed the Committee. Asking what was the justification for the Bill, he said he found himself in some difficulty. It might be that he was not sufficiently alert to apprehend what was at the back of the promotion. The position was that Mr. Milne Watson said he wanted the minimum dividend in order to give stability to the stocks of the Company; and yet under another clause of the Bill it was proposed to raise money in a manner which would not be affected by any question of stability—viz., by borrowing. If the Company had said that they were in immediate need of capital, and were going to raise it by issuing ordinary shares, but were handicapped because the dividend on the ordinary shares was jumping about, he could at least have understood the argument; but as the Bill had been put forward, he really could not see what case he had to answer. The facts had shown that, without any undue delay, the Company were able to make application under the Gas Regulation Act for an alteration in the standard price if the dividend fell as a consequence of the price having to be increased through circumstances beyond the control of the Company. If the Company had been able to say that their dividends had consistently fallen since the Gas Regulation Act came into force, and that their stock, as a consequence, stood lower than it had ever stood before, there might have been something to be said for the present proposal. But the procedure under the Act of 1920 was so flexible and responsive that an application could be made to the Board of Trade for an adjustment of the standard price—which, in fact, was exactly what had happened with the Gas Light and Coke Company. Without that Act, the sliding-scale would again have shown its weaknesses; and the very experience of the Gas Light and Coke Company, who had had their standard price adjusted only last year, was the most convincing proof that there was no justification for the proposal.

No evidence was called on behalf of the London County Council and the Middlesex County Council.

Monday, June 21.

Mr. Arthur Moon, in his address to the Committee, made much the same points as the Hon. Evan Charteris. He said that there would be no objection to the minimum dividend being applied to new capital; but it was not fair to apply it to the existing capital. If the Committee were of the opinion that the principle of the South Metropolitan Act should be adopted for the benefit of the Gas Light and Coke Company, then they should make the minimum dividend applicable only to new capital, and, at the same time—as was done in the South Metropolitan case—fix the minimum dividend at a figure below the standard dividend. Certainly the minimum dividend ought to be reduced to 4½ p.ct., assuming the Committee adopted the principle of the South Metropolitan Act. At the same time, Counsel reminded the Committee that, although the passing of this Bill would take the Company outside the Gas Regulation Act so far as revisions of price were concerned, it still left the local authorities compelled to proceed under the Gas Regulation Act if a reduction in the standard price was thought necessary. He asked the Committee to reject the proposal altogether, or, in the alternative, to reduce the minimum dividend below 5 p.ct., and make it applicable to the new capital only.

The Chairman (giving the decision of the Committee) said they found the preamble of the Bill proved. The Committee, he added, were of the opinion that any further issue of capital must be utilized for repayment of the sums borrowed from the special purposes fund, the superannuation fund, and in other ways.

Mr. Beveridge (speaking for the promoters) said the intimation of the Chairman with regard to the investments would be carefully considered by the Board. That expression of opinion would not appear in the Bill.

The Chairman replied that, whether or not it appeared in the Bill, he was satisfied it would be loyally carried out.

LONDON COUNTY COUNCIL (GENERAL POWERS) BILL.

Incombustibles in Coal.

This Bill was under consideration last week by a Committee of the House of Lords, presided over by Lord Redesdale; and a clause in it dealing with the sale of coal was the subject of opposition. The object of the clause was to make it unlawful to sell in the County of London coal containing an undue proportion of slate or slack or incombustible matter, and to render persons contravening its provisions liable to a penalty not exceeding £10 on summary conviction (see "Journal" for Jan. 22, p. 162). There was opposition to the clause from the Society of Coal Merchants. It was stated that the clause concerned domestic coal only.

The Hon. Evan Charteris, K.C. (for the London County Council), said that the clause aimed at correcting the practice of some unscrupulous dealers of selling to domestic consumers coal of an inferior quality at too high a price. It was not aimed at scrupulous traders such as those represented by the Society of Coal Merchants. The reason why the clause was asked for was that it was difficult under existing legislation to deal with offenders, who were out to make profits without regard to the nature of the article sold. It was in connection with the cheapest coal that could be obtained that these practices made themselves manifest.

Attention was called to a report submitted by the Home Office, after consulting the Board of Trade and the Secretary for Mines. In this it was pointed out that there was no precedent for the clause, and attention was drawn to the absence of a definition of the vague expression "undue proportion of incombustible matter." Counsel pointed out that if action were taken under the clause, it would be for the Magistrate to interpret that expression, having regard to all the circumstances, as was the case with other expressions used in legislation—such, for instance, as the word "reasonable."

The Chairman remarked that coal might contain some substance such as wood, which, while not being incombustible, would not be the material which the consumer thought he was buying.

Mr. *A. G. Chamings* (Chief Officer of the Public Control Department of the London County Council) said that the practice complained of was not widespread, but was limited to a particular kind

of merchant. Cases discovered, however, had been of so serious a character as to impress the London County Council with the necessity for securing better machinery under which they could be dealt with.

Cross-examined, he disagreed with the suggestion that the operation of the clause would inflict injustice on reputable dealers.

Mr. W. E. TYLDESLEY JONES, K.C. (for the Society of Coal Merchants), said he fully appreciated the position of the County Council, and believed that the present Council would use the powers, if granted, in a reasonable manner. The granting of the clause, however, would create a precedent, which would have a serious effect in parts of the country where municipalities might not be guided by men so reasonable as the present members of the London County Council, and its officials. It was not a question of what might be called "foreign matter" in the coal. Every lump of coal contained incombustible matter, and even good coal might have in it incombustible matter, including water, up to 25 p.ct. It was impossible for any dealer to know what a magistrate would consider an undue proportion. It had been said that a magistrate, in considering a case, would have regard to all the circumstances, and in particular to the price; this would have the effect of enabling a London magistrate to fix the price of various qualities of coal, which was an undesirable principle. It had been admitted by the London County Council, he said, that there was little victimization of the public by dealers; and he contended that the purchaser of coal had sufficient remedy under the existing law, and that there was no such clear evidence of necessity as would justify the creation by Parliament of a new offence.

Prof. *W. G. Fearnsides*, M.A. (Professor of Geology, University of Sheffield), gave evidence as to the difficulty of sampling coal for the purpose of taking action under this section. Power was asked to stop vehicles and enter premises for the purpose of inspecting and taking samples of coal, and to require the owner or person in charge or the occupier of premises to furnish reasonable information with regard to such coal. He doubted whether one sack taken from a consignment would be a fairly representative sample of the bulk, and pointed to the difficulty of examination—involving, as it did, sizing, screening, and so on.

Mr. *H. Cecil Rickett* (Vice-Chairman, Messrs. Rickett, Cockerell, & Co., Ltd., London Coal Merchants, and Chairman of the Society of Coal Merchants) pointed to the impracticable and possibly unfair nature of the clause. He had already suggested, he said, that the clause be withdrawn and that the County Council officers should make further investigation, and had said that the Society of Coal Merchants would be willing to co-operate with them in every possible way in order to put down the evil complained of, if it could be found to exist. Under the clause he suggested that any *bona fide* merchant might be subjected to harassing regulations and possibly indignity.

The Committee decided to grant the clause, subject to amendments. Subsequently, the words "an undue proportion of slate or slack or incombustible matter" were deleted, and the clause was amended to make it unlawful for any person to sell coal in the county "having admixed therewith an amount of slack or rock or incombustible matter which, having regard to all the circumstances of the case, constitutes an undue proportion of the total coal sold."

HOUSE OF LORDS.

Royal Assent.

The Ascot District Gas and Electricity Bill and the Helensburgh Gas Order Confirmation Bill received the Royal Assent on June 16.

Special Orders.

The Ellesmere Gas Order, 1926, was laid before the House on June 14, and referred to the Special Orders Committee.

BARNET DISTRICT GAS AND WATER BILL.

This Bill has been under consideration for some long time—the proceedings having been interrupted by the general strike—by a Committee of the House of Lords, presided over by Lord Darling. The proceedings, however, were confined to the provisions dealing with water supply; and we understand that there are no alterations of a substantial character to the gas clauses (see "JOURNAL" for Jan. 20, p. 161).

EASTBOURNE CORPORATION BILL.

The Bill of the Eastbourne Corporation was recently considered by a Committee of the House of Lords. Originally there was a petition by the Eastbourne Gas Company against a clause giving the Corporation power to construct electrical sub-stations under streets, the object of the Gas Company being to secure protection against damage to their mains. The petition was withdrawn, however, as the result of agreement, the effect of which was that the Corporation must not exercise the powers given under the clause in such a way as to affect or interfere with the apparatus of the Gas Company, or with the laying of it, without the Company's consent. Power is given to a court of summary jurisdiction to adjudicate in cases where it is alleged that the Company's consent is unreasonably withheld.

HOUSE OF COMMONS.

Gas Regulation Act.

A copy was presented of a draft of a Special Order proposed to be made by the Board of Trade under the Act, on the application of the Ellesmere Urban District Council.

LEGAL INTELLIGENCE.

HELPS v. OLDHAM CORPORATION.

Tuesday, June 15.

Mr. WHITEHEAD, K.C. (for Mr. Helps), resumed his cross-examination of Mr. W. Moncrieff Carr, General Manager of the Stretford and District Gas Board.

Witness stated that, in 1905, Southampton applied for power to distribute low-grade gas, and Parliament refused this power. Complete gasification plant had been produced abroad at the time Mr. Helps communicated his ideas to Oldham. Witness instanced what was being done in Germany in 1918. There were also, he said, articles in the "GAS JOURNAL" about that time, with reports by Mr. Cotton. The production of low-grade gas was uneconomical with existing mains. The therm at Stretford was sold at 9½d. maximum and 5d. minimum. The average was 7·7d. Distribution by nitrogen was not novel in 1918; it was used to bring the calorific value of gas down from 500 to 350 B.Th.U. He availed himself of it when he wanted to use 350 gas for testing burners; and it was in general employment by engineers. As to inerts, an Investigation Committee of the Board of Trade found that town gas mains were not large enough to admit of the distribution of 30 p.ct. of inerts.

COUNSEL: As to the statement that, contrary to general belief, service does not depend on calorific value, but primarily on the mixture of gas and air, was not that novel in 1918?

Witness: No. It does not matter whether the air is mixed at the works or at the burner, so long as it is a satisfactory mixture. It is a first principle that one must have a proper mixture to get combustion. They had been working for years to bring it about.

His LORDSHIP: When were ring burners with adjustable air admission adopted?

Witness: Generally in 1912.

COUNSEL: Was Mr. Helps's suggestion that best efficiencies in use could be obtained by a gas diluted with air at the works novel?

Witness: No. The reason it was not done long before was owing to distribution difficulties and cost.

Mr. *Ernest Parry*, the Commercial Superintendent of the Gas and Water Departments of the Oldham Corporation, giving evidence, said the claim of Mr. Helps in 1918, that he could produce gas at one-third the usual cost, attracted him. When they had the installation, it fell to him to write complaining that the plant was not performing what it was expected to do. The Oldham Corporation had paid £10,582, and the contract price was £10,925.

His LORDSHIP (to Sir Arthur Colfax, K.C., for the Corporation): If I am in your favour, are you going to ask me to assess the damages?

Sir ARTHUR COLFAX: We are not claiming anything additional to £4257 under the terms of the guarantee in the licence contract of June 4, 1919.

Witness, continuing, said he wrote Mr. Helps: "We have been greatly interested in the article which appeared in the 'GAS JOURNAL' for March 26, 1918." He had discussed the "GAS JOURNAL" article with Mr. Duxbury; and they both had read the account of Mr. Cotton's lecture. Mr. Helps sent back a form of contract, and after this negotiations proceeded.

Witness, in cross-examination, said the Oldham Corporation let out gas stoves, gas fires, and gas wash boilers practically free, and they charged by the cubic foot. After writing to Mr. Helps about his process, witness visited Nuneaton, impressed by the fact that Mr. Helps's burner seemed to be much more efficient than the one they were using at Oldham. They had complaints, however, when Mr. Helps's burners were sent out to Oldham consumers, who would not make adjustments, with the result that things went wrong. When the flame flattened out, it cracked some of the metal on the top of the stoves. When witness returned to Oldham after his first visit to Nuneaton, he reported to his Committee, telling them that the burners he had seen gave double the efficiency of the burners they were using at Oldham. He wrote to Mr. Helps saying he had told his Committee of the revolutionary nature of the burners.

Wednesday, June 16.

Mr. WHITEHEAD continued his cross-examination of Mr. Ernest Parry, who said that the general experience of those who had vertical retorts was that it was more economical to make gas of 450 to 500 B.Th.U. than of 600 B.Th.U. The Oldham Corporation had on occasions made gas as low as 400 B.Th.U. In one of the annual abtracts of the Corporation, signed by himself, occurred the words: "The Pleno plant has been put to work during the year, and has given very satisfactory results." Witness added that in June, 1921, the plant was still in an experimental stage, and engineers looked forward to the fulfilment of their hopes. A month before he had written the sentence mentioned, the plant was bought for complete gasification. They could not pay until they knew the ultimate results. He wrote: "It has not yet given the result guaranteed. Indeed, at the moment we find difficulty in getting any regular results on the plant." It was true that, with coke, the results were not unsatisfactory, but the plant was put in for complete gasification. Final payment was accordingly held up when requested.

Mr. *Timothy Duxbury*, Gas Engineer, of Oldham, said they had made gas as low as 451 B.Th.U. before they went to Nuneaton, and had diluted gas with air at Higginshaw. Before they went to Nuneaton there was a request from the Government to bring down their calorific value to 450 B.Th.U. The air was admitted at the purifier inlet until Mr. Helps, who was at one time at Oldham, suggested that compressed air should be injected at the purifier outlet. They began with Mr. Helps's plant on Sept. 29, 1920, on coke. They could never run satisfactorily with coal. Their first gas coal caked, and then they tried a dozen varieties of Lancashire and Yorkshire steam coal and Annesley coal, but the area of the tubes in the superheaters prevented enough air going into the plant to keep up the temperature in the retort. They could never get the heat in the retort to carbonize coal.

His Lordship: Are you using less coal at Higginshaw now?

Witness said they were. They made 25 p.ct. of producer gas and 75 p.ct. of coal gas, and used less coal than when they made 100 p.ct. of coal gas. In the Yorkshire coal strike in 1920, and the general strike of 1921, they got down to a low-grade gas, and people accepted it in the circumstances—it was that or nothing—but ordinarily consumers complained if they were supplied with gas below 450 B.Th.U. The figures given in the "Gas Journal" for Jan. 11, 1922, as his figures at a demonstration with a "Pleno" gas boiler were correct, but all these results were obtained on coke. Some people had been shown over the works at the time the report in the "Gas Journal" appeared.

Witness, in cross-examination, said that for a time after June, 1919, he and his Committee worked under the licence agreement with Mr. Helps, and witness's own experience with 450 B.Th.U. gas was the one thing that made him think that what Mr. Helps told him was not new. Mr. Helps's burner, he agreed, was a good one, giving splendid results in the laboratory; and he got confirmatory results when he tried it at Oldham.

Dealing with the cleaning of the plant, witness said that with ordinary gas coal little cleaning should be necessary. In the "Pleno" plant as originally made, there seemed no special places for cleaning. The Corporation put in a number of flanges in the apparatus. It was not fair to draw the conclusion that when low-grade gas was being supplied, customers did not use more. Daylight saving had made a great difference; it saved at least 100 million c.ft. of gas a year. Had it not been for this, and for the fact that mills were becoming more and more fitted with electricity, the consumption of gas in 1924 would have been much greater. Mr. Helps's plant was put in for use with any or all of the existing plant, and Mr. Helps did not say that the whole of the plant should not be used together.

Thursday, June 17.

Mr. *Duxbury*, speaking of Mr. Helps's "Pleno" plant, observed that it was absolutely impossible to work the plant as originally erected.

Mr. Whitehead intimated that he had been through the daily reports of the works foreman, and in those he found no mention of the plant ever having been blocked. There were, however, he would say in fairness, references to the "Pleno" plant being cleaned, though that might not be for blockages.

Witness, turning to the correspondence, said there was a letter of Oct. 28, 1920, in which Mr. Helps was told that the contract price would be brought up to £10,925, and a balance of £2332 would be paid him after the next Council meeting, with £320 on account of the sampler. Those cheques were paid, and would not have been paid except on the report of witness that the plant was working satisfactorily. He had said that he was satisfied the Committee were getting the results guaranteed by Mr. Helps; but he meant they were getting it only on coke fuel, and it was always known by the Committee that it was not on coal.

Mr. Whitehead: You knew the guarantee was in respect of coal. I put it to you that you reported that the results had been on coal.

Witness denied this. He agreed that a letter was written by the Town Clerk, Mr. Williams, on Oct. 11, 1920, that, subject to the plant at Higginshaw proving satisfactory, ¼d. per 1000 c.ft. of gas made at those works would be paid to Mr. Helps. A letter of witness's of Oct. 23, 1920, said: "The 'Pleno' plant is entirely satisfactory;" but that meant on coke. It never had worked satisfactorily on coal. They had blockages of the plant on many occasions, some very serious. One in December, 1920, took two to three weeks to clean out. At Mr. Helps's suggestion they bought 50 tons of Annesley Hall coal, for £113, to use with the "Pleno" plant; but they would not think of using such coal for straight gas making.

Sir *Dugald Clerk*, F.R.S., Past-President of the Institution of Gas Engineers and of the Society of British Gas Industries, said he was familiar with Mr. Helps's ideas and his specification No. 111,495, and he did not find there the disclosure of anything new and useful to the gas industry in April, 1918. Witness advocated in a paper, in 1902, at the Southampton meeting of the Gas Institute, the adoption of a calorific standard in preference to an illuminating standard. Mr. Helps's claim that low-grade gas could be more economically produced than high-grade gas was known in 1918. Witness said that as far as the published information went, he knew of no ground for thinking that any saving had been accomplished at Nuneaton by what had been practised there.

His Lordship: What is the invention Mr. Helps claims by this specification?

Witness said he seemed to claim some results from the mere act of dilution. Witness said that, looking at the plant of the Higginshaw Works, he concluded that they could not destructively distil any useful proportion of the coal in the retort. There was not sufficient heat. Whether producer gas was passed through, in part or wholly, one could not get in the retort a sufficiently high temperature destructively to distil the coal and make a proper coal gas. Even with a blower to blow air into the lower part of the apparatus, one would not distil the coal, although the temperature might be raised a little.

Mr. Trevor Watson: Would you say, with all the other witnesses, that Mr. Helps's "Pleno" burner is a very fine one?

Witness: I should not agree. I know in your own experiments you put the efficiency of an old-fashioned ring burner at 30 p.ct. and the "Pleno" burner at 60 p.ct., but I have put 60 p.ct. as the standard of burners for the United Kingdom. Unfortunately you took a very poor specimen of ring burner. You may find burners as bad as that in Britain, but I hope it is not common. Witness agreed that, as reported in the "Gas Journal" of Nov. 5, 1918, Prof. Cobb, in respect of the tests with the ring burner, the gas fire, and the incandescent mantle, said they were all surprised to find the extent to which the efficiency in use of the gas fire and the ring burner was dominated by the number of calories supplied, and how little by the grade of gas. Sir Dugald said he himself took part in the discussion reported in the "Gas Journal." The exact number was not known, but he himself was not surprised, as Prof. Cobb was. The research indicated in the "Gas Journal" followed the work of the Investigation Committee of the Institution of Gas Engineers and the University of Leeds on Heating and Ventilation.

Friday, June 18.

Sir *Dugald Clerk's* cross-examination was continued. He said he was all for cheap gas. The researches of Prof. Cobb and the other gentlemen, reported in the "Gas Journal," showed that it was well to go below 500 B.Th.U. He, himself, thought that excellent results would be got with gas at 400 B.Th.U. He did not attend Mr. Helps's demonstration at Westminster. He thought Mr. Helps's views in some respects were very fallacious.

Witness, answering his Lordship, said that when Mr. Helps was treating gas diluted with air as a low-grade gas he thought that was a fallacy of a very dangerous kind. Experiments between a gas with air introduced at the nipple and the same gas without air told nothing. The only thing he had done was to add air. There was no increase of the number of heat units.

His Lordship: There is no difference of chemical composition?

Witness: No, there is the same chemical composition at the burner. He continued that there was no settled or uniform condition of gas throughout the kingdom. Gas was conditioned always by local circumstances.

Mr. *Duxbury* was recalled to give some particulars of the employment of Annesley Hall coal in Mr. Helps's plant. Answering Sir Arthur Colfax, K.C., witness said Mr. Helps suggested the trial with Annesley Hall coal, and the Corporation bought and used 50 tons. Mr. Helps did not suggest that they should get any more. This coal proved a failure. The Corporation then obtained various steam coals. Mr. Helps did not say he disapproved of any of the steam coals they got. He knew they were trying them. They did not succeed with any of these coals in running the plant. That was all within Mr. Helps's knowledge.

Sir Arthur Colfax said that the claim was for damages and royalty as alternative to damages. There was no suggestion that the Corporation had disclosed to anybody ideas in breach. It was a case of damages for user or, alternatively, royalties under the licence, and he submitted that the case was misconceived at the outset. The Corporation decided to erect the test plant and test it; the agreement for the testing, he should submit, had never come to an end, and there had been no adoption of the invention by the Corporation. There was to be a time within which the Corporation were to decide whether they would adopt the invention; and they had not adopted it, and so had no royalties to pay. They had done nothing in breach of their preliminary agreement. The royalty period had not begun to run; and that was a complete answer to the claim. But he did not stop there. He said the basis of any agreement was that Mr. Helps was in possession of ideas or knowledge unknown to others, and otherwise unprocurable; and if there were to be damages for user, it must be because of something of which there was no knowledge at the time. But the processes had not worked, except on coke, and the parties never came to an effective agreement, because the circumstances had never arisen under which they could be supposed to come to an agreement.

His Lordship observed that there was payment of the whole purchase money and a report that the plant was working satisfactorily.

Sir Arthur: On coke. Mr. Helps's men remained in charge to the date of the writ. We never had control of it. There was no adoption by the Corporation of the invention. Counsel submitted there was nothing that was not known before the parties met, and the Corporation had never done anything that was not within the claim. If there was any contest about use of Mr. Helps's burners, the Corporation bought them, and could use them as they would. Dilution of gas they had practised before, bringing it down in the emergency time and fixing their standard at 450 B.Th.U. Much of the case came down to the burner. The fact was that two gentlemen went to Nuneaton and were mesmerized by the tests they saw on Mr. Helps's burner—and there was no doubt Mr. Helps had got a good burner—but whatever right he had in it the Corporation obtained the right of use when they bought the burners from him.

Restriction of Glasgow Gas Service.—The Glasgow Gas Department have decided to restrict the supply of gas as follows: On weekdays gas will be available only between 7 a.m. and 9 a.m., between 12 noon and 1.30 p.m., between 5 p.m. and 6.30 p.m., and between 10 p.m. and 11 p.m. On Sundays the hours of supply will be 8.30 a.m. till 10 a.m., 11.30 a.m. till 1.30 p.m., 5 p.m. till 6 p.m., and 10 p.m. till 11 p.m. Consumers are advised that all gas lights and appliances should be turned off at least five minutes before 11 p.m. Users of by-pass or pilot lights are asked to extinguish these until the supply is again normal. For seven weeks, it must be mentioned, the Department have maintained a full supply—an achievement greatly appreciated by the dwellers in Glasgow.

MISCELLANEOUS NEWS.

GAS REGULATION ACT APPLICATIONS.

There have appeared in the "London Gazette" the following notices regarding applications to the Board of Trade under the Act.

DECLARATIONS OF CALORIFIC VALUE.

Leigh Corporation.—420 B.Th.U. (Aug. 1.)
Widnes Corporation.—475 B.Th.U. (Sept. 11.)

BRITISH INDUSTRIES FAIR, 1927.

At a meeting held at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1, on Thursday, June 17, Mr. ARTHUR M. SAMUEL, M.P., gave some information about the British Industries Fair, 1927. This, he said, will take place at the White City, London, and at Castle Bromwich, Birmingham, from Feb. 21 to March 4 of next year. Speaking about the 1926 Fair, he remarked that it was a great success, especially as regards orders. Ever since the British Industries Fair was started, he continued, it had been well supported, and many small firms had built up a large business from the opportunities which it had afforded them at a very small outlay. He could mention cases, which were almost romantic, of businesses whose foundations had been based on an exhibit at the Fair at a trivial cost. This was no exaggeration, because the small manufacturer who would be content with a stand 8 ft. square could obtain all his requirements, including space, erection of the stand, handling of his packing cases, electric lighting, and his catalogue entry—besides the assistance of a vast advertising campaign and the whole-hearted help of the officers of the Department of Overseas Trade, who could be found in every important city and capital in the world—for a sum of less than £20. This assistance was real and intensive, for the Department had 36 commercial diplomatic officers attached to the various Embassies and Legations, 14 trade commissioners in the Dominions and Colonies, and 56 Imperial trade correspondents, in addition to nearly 400 regular members of the Consular Service. All these were working for the success of the Fair.

Every year, said Mr. Samuel, each overseas officer revised his list of trade buyers whom he considered should be invited to the Fair. Many of these buyers were approached personally; all of them by letter. This year the list of foreign buyers would total not less than 50,000, and each one would receive a series of three letters in his own language, informing him of each stage of the Fair's development, and finally the invitation from His Majesty's Government to attend. The Department hoped to distribute to buyers overseas 10,000 catalogues in advance of the opening of the Fair. Last year the Government allotted a sum of £25,000 for expenditure on publicity for the Fair. This year a similar amount had been made available, and the Department would again have the advantage of the services of Sir C. Higham. Each year the organizers of the Fair profited by experience—not only by their own experience, but by that of the exhibitors at the Fair, who themselves formed an Advisory Committee, in regard both to its management and to the publicity services in connection with it. They were all business men whose interests were at stake. For years past the Department had worked in close co-operation with the Birmingham Chamber of Commerce, and at no time had this co-operation been more real and more efficient than it was now. They regarded both sections of the Fair as being of one Fair; and they were equally interested in both. As far as he knew, said Mr. Samuel, this was the only all-British Fair. It was also, he believed, unique in that throughout the Fair there was no duplication. It was a real sample fair. On each stand there was shown only one example of each article made, and they would not find its duplicate in any other stall, either in London or in Birmingham. This strict adherence to classification and non-duplication made it simple for a buyer to lay his hands on what he wanted at the best price obtainable and with the least possible delay. He emphasized the unique qualities of their own Fair. They were in sympathy with all trade fairs in which there was a preponderating percentage of British-made goods shown by British manufacturers and merchants.

The date of the 1027 Fair had been fixed so that it would take place immediately before the Leipzig Fair opened. The latter was followed by a continuous round of other Continental fairs lasting well into the spring. The more they could group their trade fairs round a date commonly acceptable, the greater would be the attraction to the buyer from overseas. The extraordinary development in the size and number of Continental fairs since the war pointed to general recognition of their commercial value. He did not hesitate to say that in the quality of the goods shown, and in the completeness of its organization, the British Industries fair was second to none.

Reduction in Price at Driffield.—The price of gas to private consumers at Driffield is to be reduced on July 1 from 4s. 2d. to 3s. 9d. per 1000 c.ft.

Glasgow Lighting Department.—In his report on the work of the Glasgow Corporation Lighting Department for the year 1925-26, Mr. S. B. Langlands, Inspector of Lighting, states that generally there has been continuous progress in raising the standard of lighting in the main thoroughfares and in the lighting of new streets and of new common stairs in housing schemes. Progress has been made in the conversion of small lighting units to large units. The installation of high-power gas lamps in Bothwell Street was extended through Elmbank Street to Bath Street. Important tramway routes, 'bus routes, thoroughfares much used by general vehicular traffic, streets connecting main thoroughfares, and side-streets adjoining thoroughfares were given improved lighting according as special ground of complaint, development of fast traffic, alterations by other Departments, and other causes compelled immediate attention.

MORNING WORSHIP AND SUNDAY DINNER.

"The Sunday dinner is one of the most reasonable excuses of many people of declared religious belief who fail to go to church, and is a potent cause of non-attendance at morning services," declares the Rev. Frederic C. Spurr (Ex-President of the National Free Church Council) in a remarkable article in the "Aberdeen Press and Journal." "Were it not for the Sunday dinner," he continues, "we might easily restore the morning as an occasion when the father, the mother, and the children might, as of old, attend service together.

"The well-meaning person who advocates a cold meal on Sunday is suggesting an act of sacrifice which is opposed to the national health, and to the welfare and contentment of the individual, and which is, moreover, absolutely unnecessary in these days of simplified cookery. I suggest as alternatives:

(1) That the churches might arrange to hold their morning services at nine o'clock, as on the Continent, in order that housewives can cook the dinner afterwards.
(2) That housewives should employ one of the many wonderful gas or electric cookers now available from Corporation Departments, which can be set to cook the dinner in safety during the cook's absence.

"In making the latter suggestion I am not speaking wildly, but from actual experience. My family and I for a long period regularly entrusted our gas cooker to cook the Sunday dinner while we were at church. We returned to find the meat properly cooked and the vegetables on the hotplate nearly ready for serving.

"Many of my friends adopt the same practice, and, after all, in this 'press the button' age, it would be rather remarkable if we had not eliminated or reduced the human element in our cooking risks. Many gas cookers nowadays are equipped with thermostatic heat control. They have a numbered dial on the side, and all the cook has to do is to set the dial to the key number for any given dish, and the cooker does the rest. The gas pressure and the heat are automatically adjusted in the absence of the cook at church.

"The Church would do well, I think, if it recognized the sanctity of the Sunday dinner and other established usages of the Englishman's home. We should get nearer to the truth of our own failure and consequently nearer to a solution."

LONDON CHAMBER OF COMMERCE.

Household Appliances Section.

In comparatively recent years the growing scarcity of domestic help, and the raising of the standard of living of thousands of women, have jointly served to turn the attention of inventors and manufacturers to the need for efficient and labour-saving devices in household management. The capital and labour now employed in the production and distribution of these goods are considerable; and many interests are shared in common by those who are engaged in the industry. The modern tendency to deal collectively with common problems has led a number of prominent firms to come into closer relationship; and the machinery for co-operation has been found within the organization of the London Chamber of Commerce. The Household Appliances Section has been formed to provide machinery for co-ordinating the activities of the industry as a whole; to secure it from waste or exploitation; to co-ordinate and develop the education of public opinion, at present being carried out spasmodically; and to provide a means of influencing public or private bodies whose attitude is often of vital importance to the industry as a whole. The Chairman of the Section is Mr. G. E. W. Crowe; and the Deputy Chairmen, Messrs. H. Teeling Smith and E. T. Bangert. The Executive Committee of the Section includes, on the manufacturers' side, Mr. F. W. Goodenough (Gas Light and Coke Company) and Mr. E. F. Reed (Economic Gas Cooker Company). Mr. A. de V. Leigh is Secretary, and the offices are at 1, 2, and 3, Oxford Court, Cannon Street, London, E.C.

In connection with the Section there is to be a luncheon on Monday next, June 28, at the Holborn Restaurant. Sir Stephen Demetriadi (Chairman of the Council of the Chamber) will preside; and Mr. Goodenough will address the members on "The Advantages of Co-Operation in the Household Appliances Industry."

Leicester Health Exhibition.—At the Nation's Health Exhibition held at Leicester earlier this month, General Gas Appliances, Ltd., of Manchester, were awarded the Commemorative Gold Medal for their exhibit.

Buckhaven and Leven Gas Development.—Statistics laid before the Buckhaven and Leven Gas Commission show that the output of gas during the year was 100 million c.ft.—an increase of 1½ millions. The number of consumers increased by 170, to 6416.

Results at Burnley.—Burnley's Gas Engineer (Mr. J. Herbert Clegg) states that the financial result of the past year's working of his Department is a net profit of £14,638; after payment of the capital charges. The make of gas was 908,863,000 c.ft., and the gas sent out showed an increase of 2·04 p.ct. In his annual report Mr. Clegg remarks that there is a wide field for development in the use of gas for trade purposes; but to achieve the Department's object of competing with solid and oil fuels they must sell gas as cheaply as possible. There had been an increase in consumption in that branch of the Department's supply. The make of gas was 13,223 c.ft. per ton of coal. The water gas made was equal to 32·3 p.ct. of the total. The gas oil used was 505,904 gallons. Mainly due to bad weather during the winter, the progress which was hoped for in the construction of the new works at Old Hall was not obtained.

MALTA AND MEDITERRANEAN GAS COMPANY, LTD.

A Gratifying Position.

The Ordinary General Meeting of the Company was held on Tuesday of last week, at the London Offices, 59 and 60, Gracechurch Street, E.C.—Mr. A. M. PADDON (the Chairman) presiding.

The SECRETARY (Mr. C. J. Daun) read the notice convening the meeting and the Auditors' certificate; and the Directors' report and the statement of accounts were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said that the report in itself, as was the custom with their Company, was almost purely formal; and so he would direct the attention of the shareholders in the first instance to the accounts, where there would be found little that called for extenuation or excuse. When they parted at the close of the meeting a year ago, it was with the hope that the Company would be able to maintain the highly favourable situation disclosed on that occasion; and he was glad to be in a position now to inform them that not only had they maintained this favourable situation, but they had considerably improved upon it in all essential particulars. They had sold during the year nearly 9 million c.ft. more gas, which was equal to 9·16 p.ct. by way of increase. This was the largest increase which the Board had been in a position to report since the advent of the disturbed conditions brought about by the war. For the first time, he should say, within thirty years, there were indications of an extension of building in Malta, and a general activity which they might confidently expect would reflect beneficially upon the business of the undertaking. Otherwise Malta had remained in much the same condition for the past forty years or so. The unaccounted-for gas, which some two years ago evoked the unfavourable and legitimate comment of the proprietors, had now been reduced to just over 10 p.ct. This was about as low a figure as they could reasonably expect to attain in their special circumstances. Theirs was a scattered district; and gas had to be distributed over a wide area, in every portion of which they were faced with competition from electricity. This competition began a long time ago, and had been highly developed, under the auspices and direction of the Government. Where there was such competition, one could not expect to sell the same amount of gas in a street as would be the case with undertakings of a similar size but without a supply of electricity in their area. Therefore the percentage of gas unaccounted-for must be relatively high. It had, however, in two years been brought down 4½ p.ct., from 14·87 p.ct. to 10·31 p.ct.; and they were hopeful that it might fall still a little further.

THE ACCOUNTS.

For gas, the receipts in the year under review had amounted to £2851 more than in the previous twelve months; and to set against this there had been a reduction of only £678 on account of residuals, in spite of the general fall in market values. Fittings and meters, interest on deposits, and transfer fees, taken together, came to £750 more; and the total receipts were nearly £3000 up. All of this, the shareholders would agree, was extremely satisfactory. On the other side of the revenue and profit and loss account, there had been spent on coal, oil, coke, &c., £1164 less; but on maintenance the outlay had been £500 more. The plant was not only extremely efficient, but it was operated with a high degree of skill. In fact, the working results at Valletta were comparable with the very best obtaining in this country. They were far beyond anything that could be legitimately anticipated, in view of all the circumstances; and this was the main factor that contributed to the gratifying position occupied by the Company to-day. The balance of £16,404 was an increase of nearly £4000 over a year ago. In the balance-sheet the amortization account had been augmented to the extent of £3571, and the reserve account by £3627. The profit for the year was greater by £3944; and the final figure of £18,779 on that side of the balance-sheet was £5075 more than last year. On the other side, investments in Government and Bank of England stocks had risen from £56,098 to £63,833, book value, a gain of £7735. As a matter of fact, the actual value of these securities was £67,054, whereas the total capital liability of the Company amounted to only £123,065; so that, secure as was the position twelve months ago, it was even more so now. With regard to the future, he could only say that the increase the accounts recorded continued; and the Directors saw no reason why it should not go on. They were, of course, largely dependent upon their relations with the Government Authorities; and these were extremely friendly. Only that morning news had come along of the renewal of outstanding contracts with the Admiralty, who had their own electricity supply, but had come back to the Gas Company, and had expressed satisfaction with the terms arranged. Public lighting was as a rule an important element in foreign concessions; but here they were obliged to treat it as a negligible quantity, and yet were able to produce the margin of profit revealed by the accounts.

Mr. A. W. OKE seconded the resolution.

Mr. A. D. DODGSON asked whether the increase had been in the number of consumers or in the consumption per head.

The CHAIRMAN replied that there had been a small increase in the number of consumers, because of the new buildings that had been erected; but there had undoubtedly also been an increased consumption per head, largely in the direction of cooking, and to a lesser degree heating. For cooking gas was extremely popular in the South of Europe.

The report and accounts were then adopted.

On the proposition of the CHAIRMAN, seconded by Mr. STRACHAN C. CLARKE, it was agreed: "That a dividend of 3½ p.ct. (making, with the interim dividend paid in December last, 6½ p.ct. for the year), free of income-tax, be declared on the ordinary shares, and dividends of 3½ p.ct. and 3¾ p.ct., less income-tax, be declared on the first and second preference shares respectively." It was pointed out by the Chairman that this made the ordinary dividend ½ p.ct. more than it had been before.

The retiring Director (Mr. A. M. Paddon) was re-elected, on the proposition of Mr. OKE, seconded by Mr. F. H. JONES; and the Auditors (Messrs. William Cash, F.C.A., and Hyde C. Burton, A.C.A.) were similarly reappointed, on the motion of Mr. F. R. SMITH, seconded by Mr. W. H. DAUN.

The CHAIRMAN proposed a hearty vote of thanks to the officers; remarking again upon the excellent working results achieved by the technical staff, and also upon the special nature of the duties performed by those on the commercial side. All had, he said, rendered excellent service.

Mr. DODGSON seconded the vote, which was heartily carried, and acknowledged by Mr. DAUN.

Mr. F. R. SMITH said that, with such a satisfactory balance-sheet before them, they could not part without thanking the Chairman and Directors for all they had done; and he proposed a resolution to that effect.

This was seconded by Mr. C. H. RUTTER, and cordially agreed to.

YORKSHIRE AND LANCASHIRE COAL TRADE.

From our Local Correspondent.

Inquiries in the Yorkshire and Lancashire area show that, in the majority of instances, gas coal consumers have anticipated the present situation by the accumulation of stocks of coal that will last them for some weeks to come.

A certain quantity of foreign coal is on its way to this country. Some of it is rather varied in quality; but the American and Westphalian gas coals would appear to have attracted the most attention. Prices differ according to the prospective time of delivery, but are ruling for unscreened qualities in the neighbourhood of 45s. free into truck at port of discharge.

COAL POSITION IN THE MIDLANDS.

Men Trickling In.

From Our Local Correspondent.

Non-union men are slowly returning to work at a few pits in the Midlands. The general offer is an eight-hours day at the 1921 rates, with consequential adjustment of piece scales. This has been accepted by small numbers of men, and coal-getting has been resumed on these terms. There are exceptional cases in which the rates applying at the time of the stoppage are paid for an eight-hours day. At the Brereton Collieries, in the northern part of the Cannock Chase coalfield, the same rate of wages has been offered for an eight-hours day, with a bonus of 1s. per shift for men and 6d. for boys so long as the selling price remains over 25s. Profit-sharing on a permanent basis is likewise assured if the men get to work again. Gradually increasing numbers of men have accepted the offer. Generally the Cannock Chase miners have rejected overtures for a settlement on the standard terms set forth by the owners, and they take strong exception to individual bargaining.

In Warwickshire some of the pits which are producing are attracting rather more labour. Coal is being worked near the surface at one or two points in the Black Country, and pit mounds are gradually disappearing to appease the hunger of industrialists, who are thankful for even low-grade fuel. But the whole output from these various sources relieves the position only a very little. Nearly all of it is assigned under the control to food production and domestic consumption.

Coke has become much scarcer. Collieries which were operating ovens are now reserving the remnant of their stocks for keeping the pumps going.

Reduction in Price at Youghal.—At Youghal (co. Cork) a reduction of 5d. has been made in the price of gas to 6s. 8d. per 1000 c.ft.

A Factor in Electric Lighting.—A verdict of "Accidental death by electrocution" was returned at an inquest at Redcar on a boy named Henry Nellist, who, with two companions, went into some out-buildings, and was killed by grasping about 3 in. of non-insulated wire on an electric light ceiling fitting.

Burton-on-Trent Gas Department.—The report and accounts of the Burton-on-Trent gas undertaking show that the total revenue for the past financial year was £112,405, and the working expenses £100,706; the gross profit being £11,699. After meeting loan charges and other items, including £6951 for meters, stoves, &c., the net deficit for the year is £9896, as compared with a profit of £2642 for the previous year. This deficit is to be charged to the reserve fund. Including £10,476 expended during the year, the total capital outlay has been £490,724, of which £134,293 has been provided out of revenue. Gas consumed by ordinary meters for lighting, &c., shows an increase of 2·5 p.ct., for motive power and manufacturing purposes a decrease of 2·3 p.ct., by prepayment meters an increase of 9·7 p.ct., and for public lighting an increase of 8·7 p.ct. The net increase on sales was 5·1 p.ct. Gas unaccounted-for increased from 3 p.ct. to 3·78 p.ct.

TRADE NOTES.

Oxide and Coal Handling Plant at Nine Elms.

The Gas Light and Coke Company have placed orders with Messrs. Robert Dempster & Sons, Ltd., of Elland, for an oxide handling plant for a new installation of purifiers at the Nine Elms Gas-Works, and also for coal handling plant for vertical retorts at the same works.

New Purifiers for Motherwell.

The Motherwell and Wishaw Corporation have placed an order with Messrs. Robert Dempster & Sons, Ltd., of Elland, for four purifiers, 30 ft. square by 6 ft. deep, fitted with 24 in. diameter connectionless Weck's valve and main reverser valve. The work is to be carried out to specifications and plans prepared by Mr. John Wilson, the Corporation's Engineer.

CURRENT SALES OF GAS PRODUCTS

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *June 21.*

Values of products continue to firm up on account of the shortage of production occasioned by the miners' strike. Makers are very chary about offering far forward, as they cannot be certain that material will be available when the time comes.

Pitch is still called 80s. per ton, but this figure is quite nominal.

Creosote is firm at about 7¼d. per gallon net and naked at makers' works, with quite a good inquiry.

All tar spirits are firmer. Pure benzole and pure toluole are 2s. 6d. per gallon; while 95/160 solvent naphtha is firm at not below 2s. per gallon.

Pyridine bases is steady at 20s. per gallon.

Tar Products in the Provinces.

June 21.

Markets for tar products have remained steady throughout the past week.

Pitch is decidedly firmer, and higher prices are generally asked for the prompt and forward delivery. Buyers, however, are very unwilling to pay prices asked for the forward position, and state that they would prefer to wait.

Benzole and solvent naphthas are steady.

The average values for gas-works products during the week were: Gas-works tar, 52s. 3d. to 57s. 3d. Pitch, East Coast, 77s. 6d. to 80s. f.o.b. West Coast—Manchester, 71s. to 73s. 6d.; Liverpool, 72s. 6d. to 75s.; Clyde, 77s. 6d. to 80s. 6d. Benzole, 90 p.ct. North, 1s. 9d. to 1s. 10d.; crude, 65 p.ct. at 120° C., 1s. 1½d. to 1s. 2½d., naked at makers' works; 50-90 p.ct., naked, North, 1s. 9d. to 1s. 10d. Toluole, naked, North, 1s. 8d. to 1s. 9d. nominal. Coal-tar crude naphtha, in bulk, North, 8¼d. to 8¾d. Solvent naphtha, naked, North, 1s. 6d. to 1s. 7d. Heavy naphtha, North, 11½d. to 1s. 0¼d. Creosote, in bulk, North, liquid, 6½d. to 6¾d.; salty, 5⅝d. to 6d.; Scotland, 5⅝d. to 5¾d. Heavy oils, in bulk, North, 6¾d. to 7d. Carbolic acid, 1s. 4d. to 1s. 5d. prompt. Naphthalene, £11 to £14; salts, £4 to £5, bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

The Lawson Manufacturing Company (1926) has been registered with a capital of £2500, to carry on business as importers and manufacturers of gas and oil heaters, stoves, cookers, burners, mantles, and appliances for heating, cooking, and lighting.

Ministry of Health Inquiry at Accrington.

Mr. H. R. Hooper, from the Ministry of Health, conducted an inquiry at Accrington on June 16, regarding an application by the Gas Board for sanction to borrow £27,158 for the provision of new plant. Mr. A. J. Harrison (the Manager) said the 590,000,000 c.ft. of gas produced during the year ended March 31 represented a large increase on previous years. At the present time people were doing without coal in consequence of the strike; and the increased use of gas for heating and cooking was amazing. The demand had exceeded 2½ million c.ft. a day on several occasions. If this application were granted, the Board could proceed with their proposed water gas plant, and ensure a safe load of 3 million c.ft. a day. The sum of £7200 was required for this plant, £5800 for a new gasholder, £13,058 for trunk mains, and the remainder of the loan for connections and an exhauster. The Inspector raised the question of the net indebtedness of the undertaking, which he regarded as high, amounting to £387,311 on March 31. He said that if the gas undertaking had been going for many years, it ought to have cleared itself of an enormous amount of capital. It was because they had been borrowing and borrowing that the price of gas was now over 4s. per 1000 c.ft. Mr. Harrison said that, with the heavy charges of the undertaking, their only salvation was to increase the output, thereby reducing the standing charges. Unfortunately, the Board did not increase their prices during the war period. This was the root of the trouble. After the war they were left with a bank overdraft of something like £80,000 to £85,000.

Reduction in Price at Dundee.—On June 11 the Dundee Gas Commissioners agreed to reduce the price of gas by 2d. per 1000 c.ft. Treasurer Johnston, in moving the adoption of the annual accounts, said that the revenue for the year ended May 15 was £338,435, and the net result of the year's working was that an adverse balance of £23,517 had been reduced to £13,286.

New Meter Prices.—In moving the adoption of the report and balance-sheet of Meters, Ltd., for the year ended March 31, Mr. G. H. Braddock, J.P., Chairman and Managing Director, said that they had recently increased their prices to very moderate rates which bid fair to yield some profit. They could not, however, hope to benefit from the new prices, which were still below those the firm formerly obtained, for some time.

Colwall Gas Company.—The annual meeting of the Colwall Gas Company was held on June 15, when Mr. F. Ballard (Chairman) presided. The Directors reported a net profit of £362 on the year's working, as compared with £282 for the previous year. There was a substantial increase in the quantity of gas consumed. A dividend of 6 p.ct. (less income-tax) for the year was recommended, and it was decided to carry forward £58 to the profit and loss account. The Directors decided to reduce the price of gas to ordinary consumers to 1s. 5d. per therm.

L.C.C. Expenditure on Gas Inquiries.—In the report of the Public Control Committee presented at a meeting of the London County Council yesterday, it was stated that the provision made in maintenance vote No. 92 for 1925-26 in respect of public inquiries held in connection with gas charges was £500. This amount was intended to cover the expenses of applications to the Board of Trade for reductions in the standard price of gas fixed for gas companies. Two of the gas companies have, however, themselves applied for alterations in the price of gas, and the expenditure incurred in opposing their applications has resulted in the vote being exceeded by £260. The Committee recommended that the supplemental estimate (No. 92A) of expenditure on maintenance account of £260 in the financial year 1925-26 be approved.

Transactions of the
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Stourbridge Gas Department.

In his twenty-first annual report, Mr. Charles H. Webb, Engineer and Manager to the Borough of Stourbridge Gas Department, states that the sales of gas for the year ended March 31 show an increase of over 14,000,000 c.ft. on the previous year, largely due to the severe weather experienced in the December quarter of 1925. The building of new houses has continued to be brisk throughout the year; but the general state of trade has shown no improvement. The revenue account is very similar to that of 1925; the gross profit being £21,353, or about £400 less. A reduction was obtained in the price of coal; but this was absorbed by the reduced rates obtained for residuals—particularly coke. The proceeds of residuals on the cost of coal and oil amounted to 65·22 p.ct., as compared with 71·11 p.ct. The price of gas was not altered during the year. The balance from revenue account is subject to the usual charges for income-tax, annual instalments, and expenditure on mains, services, &c.; and the surplus after these deductions is £4169, an increase of over £300 on the preceding year. This figure, which is rather better than the average, and represents almost exactly 3d. per 1000 c.ft. sold, would have been larger by over £1000, but for the re-assessment of the works and mains, which took effect in the second half-year, and which will mean an annual increase of over £2000 in the future.

Ashbourne Gas Undertaking.—It was reported at a meeting of the Ashbourne Urban Council last week that the gas undertaking had been very successful during the past year. The profit for the year was £3636, and after paying instalment of loan and interest a net profit of £118 remained. Mr. L. Rose, Chairman of the Gas Committee, explained that the total make of gas had increased considerably.

Gas Profits at Morley.—In his report for the year ended March 31, Mr. H. J. Hemingway, the Secretary and Manager of the Morley gas undertaking, states that the net balance remaining after meeting all charges was £1100, compared with £705 last year. During the 27 years that the Corporation have administered the gas undertaking there have only been two years (1903 and 1914) when a larger net balance has been shown.

Bideford Gas Share Sale.—Keen bidding characterized the sale by auction at Bideford, on Friday last, of 400 £10 ordinary shares (new capital) in the Bideford Gas and Coke Company, Ltd. The shares, which carry a standard dividend of 7 p.ct., were sold in 120 different lots. Exceptional interest was taken in the proceedings, the Town Hall being filled; and the whole of the shares were readily sold at an average price of £16 17s. 6d.

Bradford Coal Supplies.—The large purchases of coal by Mr. Charles Wood (City Gas Engineer) are generally acknowledged as having been of great assistance to Bradford during the long coal stoppage. Bradford requires some 7000 tons of house coal a week; and Mr. H. Mosley (the Coal Emergency Officer)—who says Bradford is much better situated than during the miners' strike of 1921—declares that the Gas Engineer has greatly helped the city to tide over the trying situation by offering supplies from the stocks bought for gas production. Mr. Wood has been selecting the best of it for house coal.

Drogheda Gas-Works.—The Drogheda Corporation discussed the situation arising from the recent distraint on the gas-works by the Income-Tax Authorities in respect of non-payment of £700 income-tax arrears. It was stated that the Free State Local Government Department had not audited the accounts for three years, and that the Corporation had no power to appoint an auditor. The result was that confusion arose. It was further reported that the demand for tax was made verbally by the local collector, and that a proper form had not been received. It was decided to ask the Gas Committee to investigate the matter and submit a statement. Meantime, a temporary arrangement has been made with the authorities; and the gas undertaking is in operation as usual.

Edinburgh's Gas Supply.—A Gas Sub-Committee of the Edinburgh Town Council, at a meeting on June 17, considered a representation by the Engineer and Manager, Mr. H. H. Gracie, regarding the stock of coal at the gas-works. This stock has been considerably reduced during the coal stoppage. The Committee proposed to buy a cargo of American coal with a view to maintaining the supply of gas should the strike continue. It is understood that the cargo is between 10,000 and 12,000 tons, and is expected to be delivered in Leith in about six weeks. In the meantime the Committee do not intend to reduce the pressure of gas, but the public are requested to economize whenever possible. It is hoped that if this is done no definite restriction in respect of hours or otherwise may be necessary.

Stafford Gas-Works Report.—The report of the Stafford Corporation gas undertaking shows that the gross profit for the past financial year was £13,008, against £13,744 for the previous year. After deducting charges for service of debt and income-tax, a net profit of £5177 remained, which, with a balance of £2511, gave a total credit £7688. A sum of £2675 has been transferred to rate account and reserve and renewals fund; and of the remaining balance of £5013, £2000 has been allocated to the relief of the rates. The gas made for the twelve months was 323,547,000 c.ft., compared with 325,308,000 c.ft. a year ago. The make per ton was 18,772 c.ft., compared with 18,319 c.ft. in the previous year. Mr. Owen, in submitting the report to the Town Council, said the results were most satisfactory. A decrease in income from residuals had been more than counterbalanced by the savings effected in manufacturing costs; and the gas made per ton of coal was a record for the Department. He thought the Gas Engineer (Mr. T. H. Poulson) was to be complimented upon his foresight in stocking coal, thus being able to supply householders during the present trouble. The report, which was described by another member as the best the Department had ever produced, was adopted.

Increased Gas Sales at Blackburn.

The annual report of Mr. George P. Mitchell, the Blackburn Borough Gas Engineer, states that the gas manufactured during the year was 1043 million c.ft., an increase of 39 millions, or 3·79 p.ct., over the previous year. The consumption was in the following proportions: Ordinary meters, 42·09 p.ct.; prepayment meters, 41·94 p.ct.; industrial meters on rebate, 3·74 p.ct.; public lighting, 4·86 p.ct.; gas-works, 1·14 p.ct.; and unaccounted-for 6·23 p.ct. The public lamps in use numbered 2869, against 2844 last year; and the consumption of gas was 50,753,500 c.ft., against 51,377,200 c.ft.—a decrease of 623,700 c.ft. The appliances sold numbered 3078, representing a value of £24,950. The cooking and heating appliances in use in 1925-26 were 49,957, compared with 46,879 in 1924-25 and 43,805 in 1923-24. The capital outstanding in 1925-26 was £611,740, the gas sold was 967 million c.ft., and the amount per million c.ft. of gas sold was £633, compared with £620,392, 928 million c.ft., and £668 in 1924-25. The gross income was £219,502, and expenditure £158,378, leaving a balance of £61,123 to carry forward to net revenue account. After meeting interest and sinking fund charges, &c., amounting to £56,624, there was a net profit on the year's working of £7074 carried to the appropriation account, against which £6389 had been charged for a new conveyor, coke screening plant, and reconstruction of workshops and stores, leaving a balance of £1101. The conversion of the old inclined retort house for the housing of workshops, stores, and canteens had been formally opened during the year, the accommodation now provided being in every way more suitable. The contractors, Messrs. R. & J. Dempster, Ltd. (Manchester), who had in hand the erection of spiral-guided gasholders, had made good progress. The small holder was complete and ready for testing, and the large holder would be available for use during the winter. The erection of buildings and plant for carburetted water gas had gone ahead satisfactorily; and they were ready for operations to commence forthwith.

Reduction in Price at Hinckley.—The gas undertaking of the Hinckley Urban Council last year showed a record profit of £4934. The Urban Council have decided to reduce the price of gas for cooking and lighting by 2d. per 1000 c.ft., and for gas engines by 3d. per 1000 c.ft.—the reduction to come into force after the September quarter.

Lytham St. Annes Gas Undertaking.—Last year the Lytham St. Annes gas undertaking had an income of £59,032, compared with £58,617 for the previous year. The expenditure was £43,540, leaving £15,491 gross profit, to which was added £108 interest. Loans repaid and sinking fund contributions absorbed £5388, and interest on loans, &c., £10,426; the net result being a loss of £214.

Arbroath Gas to be Cheaper.—The report of the Gas Manager (Mr. A. C. Young) of the Arbroath Gas Department states that the gross profit on the year's working was £8483. The credit balance carried forward to next year amounted to £182. The price of gas is to be reduced from 3s. 2·7d. to 3s. per 1000 c.ft. (8d. per therm) to ordinary consumers, and from 3s. 6d. to 3s. 4d. per 1000 c.ft. (8·8d. per therm) to prepayment meter consumers.

James Keith & Blackman Company, Ltd.—In their annual report, the Directors state that the orders received during the year (to March 31) exceeded those of the previous year. After providing for debenture interest, payment of preference dividend, and making sufficient allowance for depreciation and reserves against doubtful debts, the audited accounts show an available balance standing at the credit of the profit and loss account of £31,272. The Directors recommend that this sum be appropriated as follows: Declare a dividend on the ordinary shares at the rate of 10 p.ct., less income-tax, absorbing £16,000; transfer to reserve account £5000; and carry forward to the current year £10,272.

Results at Barrow-in-Furness.—At a meeting of the Barrow-in-Furness Town Council on June 7, Alderman Thompson, Chairman of the Gas and Water Committee, presented his annual statement upon the working of the undertakings. He said that the quantity of gas sold during the past financial year amounted to 302,575,000 c.ft., compared with 303,907,000 during the previous year. The number of prepayment consumers had increased by 123, while there were 135 fewer ordinary consumers, the total number at the end of the year being 13,668. The number of gas cookers let out on hire at the end of March was 10,408, this being an increase of 84. During the year the 18-in. trunk main from the Hindpool Road Works to Park Drive was completed, and had proved of good service in maintaining the supply and pressure of gas throughout the area. He mentioned an experimental lighting scheme carried out in Cavendish Street at the expense of the Committee. He thought it would be agreed that this experiment was an unqualified success, and that Cavendish Street was now one of the best-lighted streets in the borough. Dealing with the accounts, £4827 had been spent on capital account. With regard to the revenue accounts, coal had cost £3803 less than the preceding year. Oil, &c., for the manufacture of carburetted water gas, cost £887 more. The sale of gas had produced £1408 less than the preceding year, due to the slightly decreased consumption and to the fact that during the first quarter of the preceding year the price was 4s. 6d. per 1000 c.ft., as against 4s. 3d. per 1000 c.ft. during the whole of the year just ended. The net result of the working of the Gas Department, after setting aside the sum of £10,223 for renewals of works and plant, showed a loss of £1720.

The workmen connected with the Distribution Department of the Accrington District Gas Board had their annual picnic on June 19, a party of 32 visiting Southport and Liverpool.

Notices of objection to the application by the Colwyn Bay Urban Council for an Order to extend the gas supply outside the Council's area have been lodged by the Llandudno Urban District Council and the Carnarvonshire County Council.

STOCK MARKET REPORT.

THERE was a considerable improvement in the amount of business transacted on the Stock Exchange last week, and investors were giving more support to the speculative markets. The substantial sums which are obviously available were attributed to the falling-off in trade by reason of the continued coal stoppage; and the influx of business can scarcely be of permanent advantage. Investment stocks, however, were not entirely neglected, and the recent new issues all stand at respectable premiums.

In the Foreign Market French loans were adversely affected by the political crisis and the further fall in the franc. Excitement still continues in the Tobacco issues, and a bonus announcement by the Imperial Company is awaited with confidence.

The feature of the week from the Gas investors' point of view was the rise of 4 points in the Gas Light and Coke Company's ordinary stock. This improvement was, of course, due to the confident belief that the Company's Bill, which provides for a minimum dividend, will receive the approval of Parliament. The Bill, which reached the Committee stage last week, was opposed by the London County Council; but the Committee were obviously impressed by the financial evidence given by Sir William Plender and Mr. C. H. Whittington, a member of the Stock Exchange Committee and the principal dealer in Gas Stocks. On Monday of this week the Committee decided to approve the preamble of the Bill. This announcement will doubtless bring about a further improvement in the value of the stock; and in anticipation of similar powers being applied for by the other companies, there should be an improved demand for Gas Stocks generally.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf.Yr	Dividends. Last Hf. Yr.	NAME.	Quotations. June 18.	Rise or Fall on week.	Transactions Lowest and Highest Prices.
£			%p.a.	% p.a.				
171,978	Stk.	Feb. 4	5	5	Aldershot 5 p.c. max. C.	74—77	..	..
322,992	,,	,,	4	4	Do. 4 p.c. Pref.	69—74	..	..
1,551,868	,,	Apl. 1	6½	6½	Alliance & Dublin Ord.	75—80	..	76½—78
374,000	,,	Jan. 7	4	4	Do. 4 p.c. Deb.	60—65	..	..
300,000	1	May 6	1/7⅛	1/7⅛	Bombay, Ltd.	1/6—1/7	..	..
170,000	10	Mar. 4	8½	8½	Bournemouth 5 p.c.	12—13	..	12½
425,050	10	,,	7	7	Do. B 7 p.c.	12—12½	..	..
275,000	10	,,	6	6	Do. Pref. 6 p.c.	11—12	..	..
50,000	Stk.	Jan. 7	3	3	Do. 3 p.c. Deb.	55—58	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb.	75—78	..	..
214,740	,,	Mar. 18	12	12	Brighton & Hove Orig.	167—172	..	..
244,200	,,	,,	9	9	Do. A Ord.	128—133	..	..
1,287,500	,,	Feb. 18	5	5	Bristol 5 p.c. max.	88½—89½a	..	..
855,000	,,	Mar. 18	8	7	British Ord.	99—104	+1	100
100,000	,,	Jan. 7	7	7	Do. 7 p.c. Pref.	117—122	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	69—74	..	..
100,000	10	June 10	6	8	Cape Town, Ltd.	6½—7½*	+⅛	..
100,000	10	Apl. 22	4½	4½	Do. 4½ p.c. Pref.	5½—6½	..	..
150,000	Stk.	Jan. 7	4½	4½	Do. 4½ p.c. Deb.	68—73	..	..
626,860	,,	Feb. 18	6	6	Cardiff Con. Ord.	96—99	..	..
237,360	,,	Jan. 7	7½	7½	Do. 7½ p.c. Red. Deb.	98—101	..	..
157,150	,,	Mar. 4	5	6½	Chester 5 p.c. Ord.	87½—92½b	..	..
79,185	1	Apl. 22	†2/-	†2/-	Colombo Ltd. Ord.	28/—30/-	..	..
24,495	1	,,	1/4⅜	1/4⅜	Do. 7 p.c. Pref.	20/—22/-	..	..
1,513,380	Stk.	Mar. 4	5¼	5¼	Commercial 4 p.c. Cap.	77—80	..	77—78
660,000	,,	,,	5/3/4	5/3/4	Do. 3½ p.c. Cap.	76—79	..	76—78
475,000	,,	Dec. 17	3	3	Do. 3 p.c. Deb.	55—58	..	..
800,000	,,	Oct. 8	—	4	Continental Union, Ltd.	26—31	−4	26—27½
200,000	,,	Mar. 4	7	7	Do. 7 p.c. Pref.	85—88	..	85
737,150	,,	Mar. 4	6½	6½	Croydon sliding scale	95—98	..	..
403,100	,,	,,	5	5	Do. max. div.	79—82	..	..
492,370	,,	Mar. 4	6	9	Derby Con.	107—109c	..	..
55,000	,,	Dec. 17	4	4	Do. Deb.	74—76c	..	..
209,000	,,	Mar. 4	5	5	East Hull Ord. 5 p.c.	86—89	..	..
60,000	,,	Dec. 17	—	5	Eastbourne 5 p.c. Deb.	93—98	..	..
1,002,180	10	Apl. 1	†6	†4	European, Ltd.	5—6	..	5—£5/4/6
18,788,960	Stk.	Feb. 18	5½	4/17/4	Gas Light & Coke 4 p.c. Ord.	84—86	+4	80—86
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	58—61	..	58—59½
4,157,020	,,	,,	4	4	Do. 4 p.c. Con. Pref.	76—79	+1	76½—78
5,602,620	,,	Dec. 17	3	3	Do. 3 p.c. Con. Deb.	57—60	..	59—60
181,315	,,	—	—	—	Do. 6 p.c. Br'tf'd Rd. Db.	102—104	..	..
130,000	,,	—	10	10	Do. 10 p.c. Bonds.	..	..	..
42,000	,,	—	7½	7½	Do. 7½ p.c. Ilford Deb.	..	..	..
82,500	,,	Mar. 18	6½	6½	Hastings & St L. 5 p.c. Conv	88—93	..	..
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	68—73	..	..
70,000	10	June 10	†10	†10	Hongkong & China, Ltd.	19½—20½*	..	..
173,200	Stk.	Mar. 4	10	10	Hornsey Con. 3½ p.c.	66—68	..	..
1,976,000	,,	May 20	10	†10	Imperial Continental Cap.	123—128	−2	123½—128
226,170	,,	Feb. 4	3½	3½	Do. 3½ p.c. Red. Deb.	69—72	..	..
235,242	,,	Mar. 18	6½	6½	Lea Bridge 5 p.c. Ord.	95—100	..	..
2,127,340	,,	Feb. 18	5½	5½	Liverpool 5 p.c. Ord.	79½—80½b	+½	80
600,000	,,	Mar. 18	7	7	Do. 7 p.c. Red. Pref.	101½—103½b	..	101½—102½
165,786	,,	Feb. 18	9	8	Maidstone 5 p.c. Cap.	115—120	..	..
63,480	,,	Dec. 17	3	3	Do. 3 p.c. Deb.	54—59	..	..
75,000	5	Dec. 3	†7	†6	Malta & Mediterranean	4½—5	..	..
541,920	Stk.	May 20	†4	†6	Montevideo, Ltd.	75—78	+1	75½—78
3,061,315	,,	Mar. 4	5	5	Newcastle & Gateshead Con.	70½—71½d	..	..
360,929	,,	,,	4	4	Do. 4 p.c. Pref.	75—76d	..	..
529,705	,,	Dec. 17	3½	3½	Do. 3½ p.c. Deb.	69—71d	..	..
15,000	,,	Mar. 4	11½	11½	North Middlesex 10 p.c.	155—160	..	..
91,580	,,	,,	8 2/9	8 2/9	Do. 7 p.c.	112—117	..	..
300,000	Stk.	May 6	9	7	Oriental, Ltd.	95—100	..	..
188,120	,,	Jan. 7	7⅞	7⅞	Plym'th & Ston'house 5 p.c.	110—115	..	..
60,000	50	Mar. 4	14	14	Portsea Island B	90—95	..	..
100,000	50	,,	13	13	Do. C	88—93	..	..
2,289,909	1	—	—	—	Primitiva Ord.	9/9—10/9	..	9/9—10/1½
282,200	100	June 1	4	4	Do. 4 p.c. Red. Deb.	83—85	..	..
600,000	Stk.	Jan. 21	4	4	Do. 4 p.c. Red. Deb. 1911	66—68	..	..
180,305	,,	Dec. 17	4	4	Do. B. Aires 4 p.c. Rd. Db.	66—68	..	..
256,847	,,	,,	4	4	Do. R'r P'te 4 p.c. Rd. Db.	66—68	..	..
150,000	10	Mar. 18	6	6	San Paulo 6 p.c. Pref.	7¾—8	..	..
125,000	50	Jan. 4	5	5	Do. 5 p.c. Red. Deb.	43—46	..	..
270,000	Stk.	Mar. 18	5½	6	Sheffield A	98—100e	−1	..
419,968	,,	,,	5½	6	Do. B	98—100e	−1	98⅜
1,047,000	,,	,,	5½	6	Do. C	98—100e	−1	98⅜
90,000	10	June 11	4	—	South African	5—7	..	..
6,609,895	Stk.	Mar. 4	5	7	South Met. Ord.	93—95	+1	92½—94½
1,895,445	,,	Jan. 7	3	3	Do. 3 p.c. Deb.	56—59	..	..
734,000	,,	Mar. 4	6½	6½	Do. 6½ p.c. Red. Db.	102—104	..	102½
91,500	,,	Mar. 4	8½	8½	South Shields Con.	117—119d	..	..
1,187,795	,,	Mar. 4	6½	6½	South Suburban Ord. 5 p.c.	98—101	..	98½—99½
368,837	,,	Dec. 17	5	5	Do. 5 p.c. Deb.	94—97	..	94½—95
647,740	,,	Mar. 18	5	5	South'mpton Ord. 5 p.c. max.	77—80	..	78⅜—79⅜
121,275	,,	Jan. 7	4	4	Do. 4 p.c. Deb.	69—74	..	70½—71½
250,000	,,	Mar. 4	7	7	Swansea 7 p.c. Red. Pref.	99—102	..	..
200,000	,,	Dec. 17	6½	6½	Do. 6½ p.c. Red. Deb.	100—102	..	..
120,000	,,	Feb. 18	7½	7½	Tottenham District A 5 p.c.	108—113	..	..
882,275	,,	,,	5½	5½	Do. B 3½ p.c.	88—91	..	89½—90
150,000	,,	,,	28/4	5½	Do. 5½ p.c. Pref.	101—103	..	..
181,255	,,	June 10	4	4	Do. 4 p.c. Deb.	73—76*	..	..
258,251	,,	Mar. 18	5	5	Tynemouth Con. and New	67—68d	..	..
197,294	,,	Mar. 4	6⅝	6⅝	Uxbridge, Maidenhead, & Wycombe 5 p.c.	90—95	..	..
88,330	,,	,,	5	5	Do. 5 p.c. pref.	85—90	..	..
91,800	,,	,,	6⅝	6⅝	Do. 5 p.c. Maidenh'd	87—92	..	..
30,000	,,	Mar. 4	8½	8½	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	123—128	..	..
255,636	,,	,,	7	7	Do. B 3½ p.c.	103—108	..	..
412,450	,,	,,	5/19/0	5/19/0	Do. C and New	88—93	..	..
352,000	,,	,,	6⅝	6⅝	Wimbledon 5 p.c.	98—103	+1	101½
98,000	,,	,,	7⅛	7⅛	Epsom 5 p.c.	105—110	..	..
88,416	,,	Jan. 7	3	3	3 p.c. Deb.	55—58	..	..

Quotations at:—a.—Bristol. b.—Liverpool. c.—Nottingham. d.—Newcastle. e.—Sheffield. *Ex. div. † Paid free of income-tax. ‡ Plus 8½ p.ct. p.a. special dividend.

It will be seen that the British ordinary, South Metropolitan ordinary, and the Wandsworth (Wimbledon) stocks all advanced 1 point, and the Liverpool 5 p.ct. ordinary ½ point. The Sheffield three stocks were written down 1 point on the local exchange, and Continental Union and Imperial Continental dropped 4 points and 2 points respectively.

The following transactions were recorded during the week:

On Monday, Bournemouth "B" 12½, British 100, European 5½, £5 4s. 6d., Gas Light and Coke 80, 80¼, 80½, 80¾, 3½ p.ct. maximum 58, 58½, 4 p.ct. preference 70½, 77, 77½, 78, 3 p.ct. debenture 59, 59½, 60, Imperial Continental 126, 126½, Liverpool 7 p.ct. preference 101½, 102½, Primitiva 10s., Sheffield "B" 98⅜, "C" 98⅜, South Metropolitan 92½, 93⅛, 93½, 6½ p.ct. debenture 102½, Tottenham "B" 90. Supplementary prices, Barnet "C" 142, Guildford 100, Romford 5½ p.ct. preference 5 1/16.

On Tuesday, Alliance and Dublin 76½, 77½, European 5, Gas Light and Coke, 80¼, 80½, 80⅝, 80¾, 80⅞, 81, 81⅛, 81¼, 81⅜, 4 p.ct. preference 77, 3 p.ct. debenture 59½, Imperial Continental 127¾, South Metropolitan 93, 94, Wandsworth (Wimbledon 5 p.ct.) 101½. Supplementary prices, Colonial 22s., Gas Light and Coke (Brentford 6 p.ct. mortgage) 98¾, Romford 5½ p.ct. preference 5 1/16.

On Wednesday, Commercial 3½ p.ct. 76, Continental Union 26, 27½, 7 p.ct. preference 85, European 5½, Gas Light and Coke 81, 82, 82⅛, 82¼, 82½, 82⅝, 83, 3½ p.ct. maximum 58, 59½, 4 p.ct. preference 77, 3 p.ct. debenture 59½, Imperial Continental 126½, 127, 127¼, 128, Liverpool 7 p.ct. preference 101½, 102, Montevideo 75½, 76, Primitiva 9s. 10½d., 10s., South Suburban 5 p.ct. 98½, Tottenham "B" 89½, 90. Supplementary prices, Mid-Kent 53s. 9d.

On Thursday, Commercial 4 p.ct. 77, 3½ p.ct. 77, Continental Union 27, 27½, Gas Light and Coke 82½, 83½, 83⅝, 84, 84½, 85, Imperial Continental 126, 126½, 126¾, 127½, Primitiva 9s. 10½d., 10s., South Metropolitan 93¼, 93½, 93¾, 94, South Suburban 5 p.ct. 98½, Southampton 5 p.ct. 78⅜, 4 p.ct. debenture 70½, Wandsworth (Wimbledon 5 p.ct.) 101½.

On Friday, Alliance and Dublin 76½, 77½, 78, Commercial 4 p.ct. 78, 3½ p.ct. 78, Gas Light and Coke 85, 85½, 85⅝, 86, Imperial Continental 123½, 124½, 125, Liverpool 7 p.ct. preference 101½, Montevideo 78, Primitiva 9s. 9d., 9s. 10½d., 10s. 1½d., South Metropolitan 94½, South Suburban 5 p.ct. 99½, 5 p.ct. debenture 95, Southampton 5 p.ct. maximum 79⅜, 4 p.ct. debenture 71½. Supplementary prices, Colonial 22s., 22s. 3d., 22s. 6d., Croydon 7½ p.ct. preference 102, 5 p.ct. debenture 91.

In Lombard Street the monetary conditions were satisfactory; but the rates were higher than for several weeks past, and at no time dropped below 3½ p.ct. The Treasury Bills were disposed of at a lower rate; the average being £4 5s. 5·54d. p.ct., or nearly 1s. 3d. p.ct. below the previous week's average rate.

The renewed failure to form a Cabinet led to a further slump in the French franc. The rate, which at one time during the week touched 180, closed at 175⅞. Belgian francs closed at 171⅞, and Italian lire were quoted at 135. Sterling on New York was steady at 4.86⅝, and there was no appreciable movement in the Dutch currency.

In the absence of support Silver declined to 30 1/16d. per oz., and Gold remained unchanged at 84s. 11½d. per oz.

The Bank Rate is 5 p.ct., to which it was raised from 4 p.ct. on Dec. 3. Bankers' deposit rates are 3 p.ct. The deposit rates of the discount houses are 3 p.ct. at call and 3½ p.ct. at notice.

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